MACHINERY

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NOVEMBER 22, 1961 ONE SHILLING & THREEPENCE

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TECHNOLOGY
ARTMENT

COLOSSAL GEARS, TINY GEARS AND ANYTHING IN BETWEEN

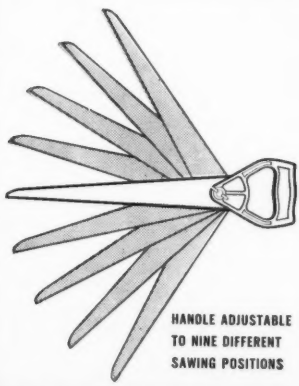
Holroyd worm gears come in all sizes and all ratios. They'll do anything you want a gear to do—from opening a door to operating in the largest steel mill. And all of them have the distinctive Holroyd features of advanced design, accurate manufacture and highest quality materials. You can have Holroyd worms and wheels made to build into your machine or you can choose a standard self-contained worm gear box from our catalogue which describes more than 2,000 combinations of sizes, ratios and types of gearbox.

Holroyd

JOHN HOLROYD & CO LTD · MILNROW · ROCHDALE · LANCASHIRE

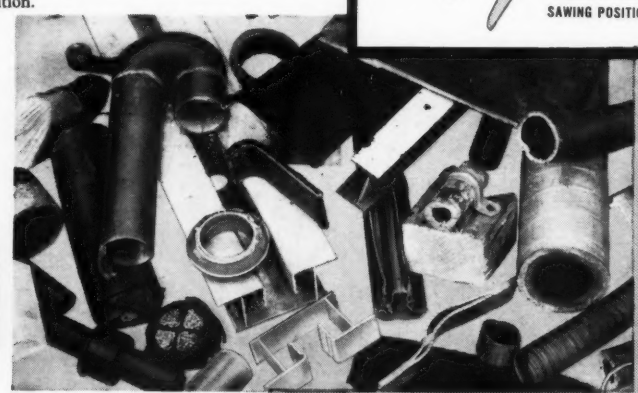
For any job—
WOOD, METAL, PLASTIC ETC.
it cuts through the lot

Here's a saw which will cut both wood AND metal — *one* saw for all the odd jobs about the house, the farm, the garden, the building site and so on. If the "odd job" is the cutting of hard wood, soft wood, wood in which nails or bolts are embedded, hard rubber, plastics, fibreboard, the every-day range of pipes and bars made from mild steel, copper, brass, aluminium, lead and the like, here's the saw that will cut through the lot! The blade can be adjusted for sawing in almost any position.



HANDLE ADJUSTABLE TO NINE DIFFERENT SAWING POSITIONS

* Price
15/6



Eclipse

general purpose saw

Made by James Neill & Co. (Sheffield) Ltd., and obtainable from hardware and tool dealers

SA. 12

TABLE
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SA. 12

"These Wild-Barfield furnaces do a really good job"

Where heat-treatment is concerned—are you doing the job as economically as possible? It's surprising the number of people who invest in expensive machine tools for production—and then spoil a good job in outdated furnaces. And the result? Rejects—time, money and probably customer goodwill lost. More and more people are relying on Wild-Barfield equipment. Write for full details and see how you can save by changing to modern electric furnaces.

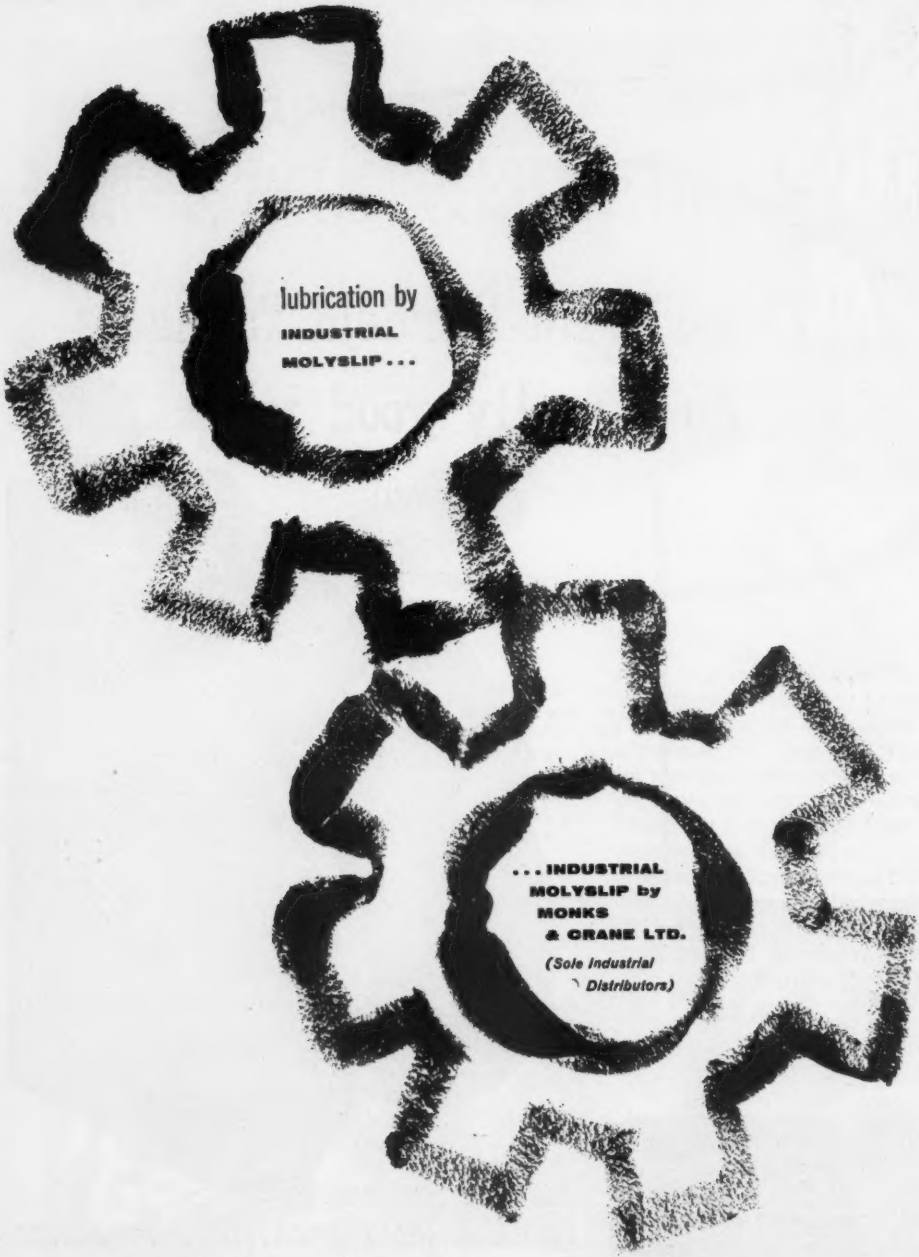
Self-contained Electrode Salt Bath ESB 346.
Standard Model delivery ex stocks

WILD BARFIELD

ELECTRIC FURNACES
FOR ALL HEAT TREATMENT PURPOSES
Backed by 40 years specialist experience

WILD-BARFIELD ELECTRIC FURNACES LIMITED

ELECFURN WORKS, OTTERSPOOL WAY, WATFORD BY-PASS, WATFORD, HERTS. Tel: Watford 26091 (8 lines) Grams: Elecfurn, Watford
WB71



Molyslip is a product of **THE SLIP GROUP OF COMPANIES,** 34 Great St. Helens, London, E.C.3 Tel: AVEnue 1636. Telex: 23755

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IS BELOMANCY

REALLY THE BEST METHOD

OF SELECTING MILLING CUTTERS

Before we go any further, you might be glad to know . . . if you haven't already guessed . . . that just as Palmistry is the art of predicting events by studying the hand, and Halomancy by casting dice, so Belomancy is the reading of the future using arrows.

Let us now assure you that if there are Milling Cutters in your future, then every arrow you come across is going to point towards Arthur Balfour. There are good reasons, for by controlled manufacture based on continuous research from the melt to the finished product, Balfour Milling Cutters ensure maximum performance throughout a long life.

Just give those arrows a chance, today... You'll pat yourself on the back tomorrow.

ARTHUR BALFOUR

ARTHUR BALFOUR & CO. LTD. CAPITAL STEEL WORKS
SHEFFIELD, ENGLAND
ASSOCIATED COMPANY: THE EAGLE & GLOBE STEEL CO. LTD.

Stocked and distributed in Southern England by
ALEXANDER S. NEWALL MACHINE TOOL Co. Ltd. MICROTRON HOUSE
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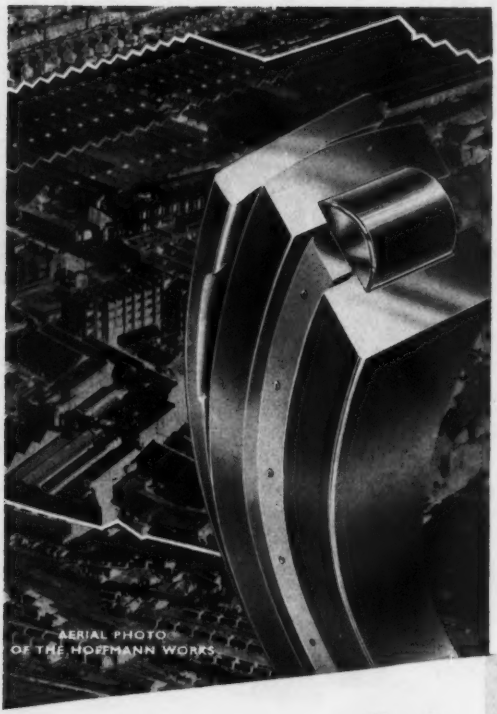


Apprentices
Draughtsmen
Designers
Production Engineers
Purchasing Officers

KNOW YOUR BEARINGS

No. 9

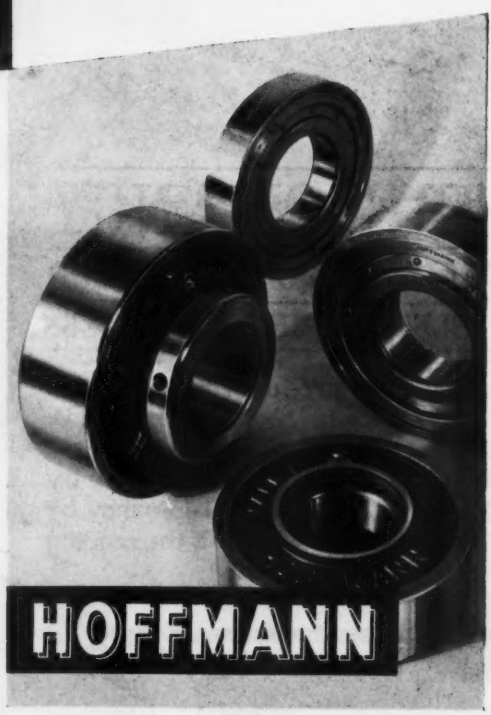
The Single Row Self-Aligning Roller Journal

This roller bearing is the counterpart of the self-aligning ball journal bearing described in No. 6 of this series. It has slightly less load capacity than the standard roller journal of equivalent size, but has greater load capacity than the ball journal bearing of the same dimensions. The self-aligning feature, independent of the rolling elements, is provided by the outer race being ground to spherical form and fitted within a shell housing of corresponding form.

The end cover also sphered, moves with the bearing, enclosing it and maintaining a fine running clearance about the rotating parts.

They are supplied with taper clamping sleeve and nut or with parallel bore for fitting direct to the shaft.

HOFFMANN SINGLE ROW SELF-ALIGNING ROLLER JOURNALS are made in the following series:-
IN INCH SIZES—LIGHT AND MEDIUM
WITH TAPER CLAMPING SLEEVE AND NUT OR WITH PARALLEL BORE



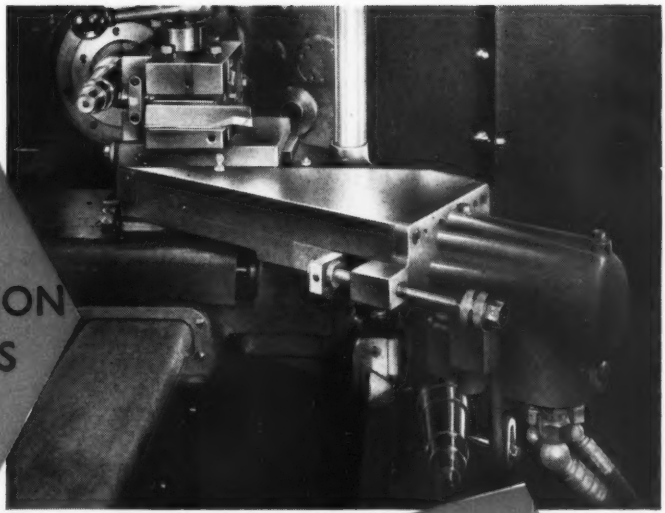
HOFFMANN

Manufacturers of precision ball and roller bearings—established 1898

THE HOFFMANN MANUFACTURING CO. LTD. (P.O. BOX 7), CHELMSFORD, ESSEX

TELEPHONE: 3151 TELEX No. 1951

1961



Ward

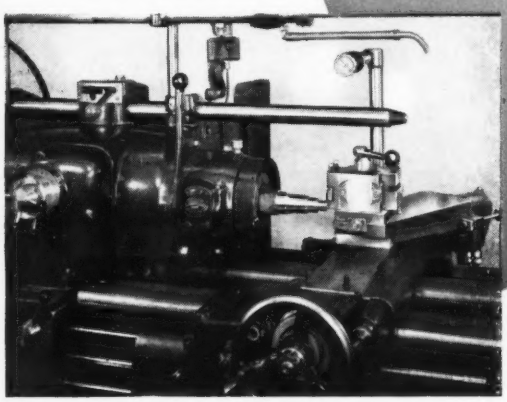
No. 7 COMBINATION TURRET LATHES

With

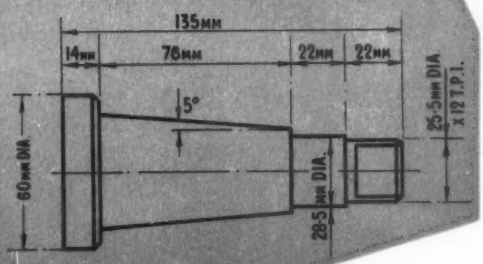
The HEPWORTH

HYDRAULIC COPYING ATTACHMENT

THIS COMPONENT
4·75 MINUTES FLOOR TO FLOOR



By courtesy of Messrs. H. W. WARD & Co. Ltd.



CHECK WITH YOUR OWN PRODUCTION TIMES

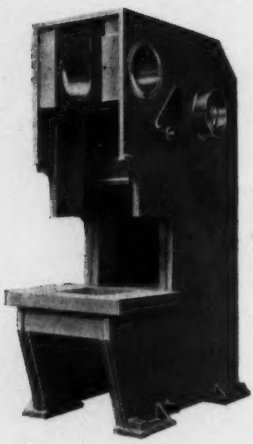
AND SEND FOR DETAILS OF THE HEPWORTH HYDRAULIC COPYING ATTACHMENT. A FULL RANGE OF UNITS ARE AVAILABLE FOR EXISTING MACHINE TOOLS INCLUDING PLANERS, MILLING MACHINES, VERTICAL BORERS & LATHES UP TO 30 DIA. SWING

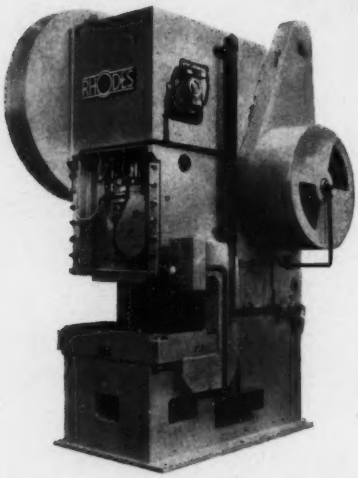
OUR EXPERIENCE IS AT YOUR SERVICE

THE HEPWORTH IRON CO. (ENG.) LTD. HIC LTD ENGINEERING **HAZLEHEAD nr. SHEFFIELD**

TELEPHONE: PENISTONE 3342/3

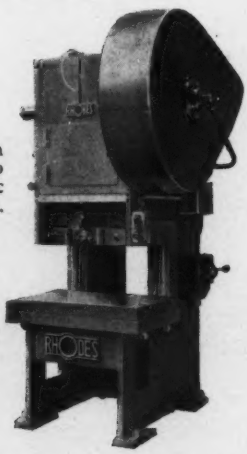
RHODES C-FRAME PRESSES . . .





The sturdy fabricated one-piece steel frame of Rhodes C-Frame Presses is only one aspect of their merits—full details of all their constructional and operational features are contained in Catalogue RFP-60.

Rhodes RF series presses are all inclinable, up to Size RF75. Inclining mechanism can be motorised.



Press with friction clutch control — available also with electro-pneumatic friction clutch and brake.

1961

with INDESTRUCTIBLE

STEEL

Full particulars in Publication

RFP-60

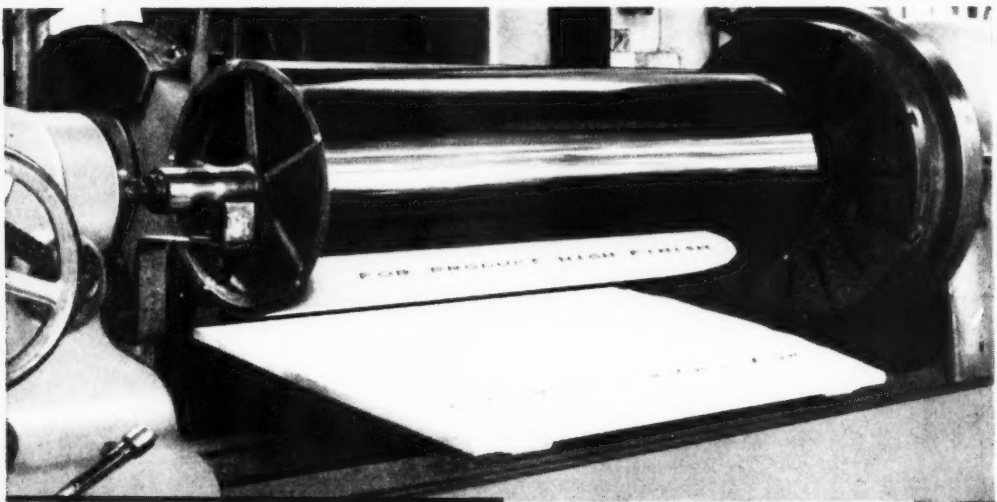
JOSEPH RHODES & SONS LIMITED

WAKEFIELD · ENGLAND · Telephone: 2756 (3 lines)

LONDON · Norfolk House, Laurence Pountney Hill, E.C.4. Telephone: Mansion House 7746-7747

RP 12

REFLECT ON THIS!

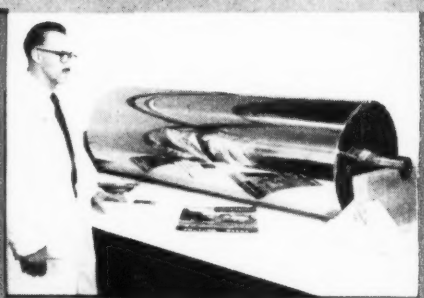


It's NEW Fescol 'HIGH REFLECTIVITY' . . .

and it means better product finishing, in addition to extreme surface hardness of the chromium deposit, providing increased life for roll surfaces.

Fescol, who first pioneered commercial applications of heavy electro-deposition over forty years ago, are pleased to introduce 'HIGH REFLECTIVITY' for use in industry.

Executives interested in this development are asked to write for information quoting ref. M.25



These photographs show the HIGH REFLECTIVITY of rollers 'FESCOL'-lined in Chromium.

FESCOL

FESCOL LIMITED • NORTH RD • LONDON N7

Branch Works at Port Glasgow, Huddersfield and Brownhills, Walsall

Established 1920 LICENSEES IN FRANCE, AUSTRALIA, NEW ZEALAND, ITALY, S. AFRICA, S.W. AFRICA, RHODESIA AND NYASALAND

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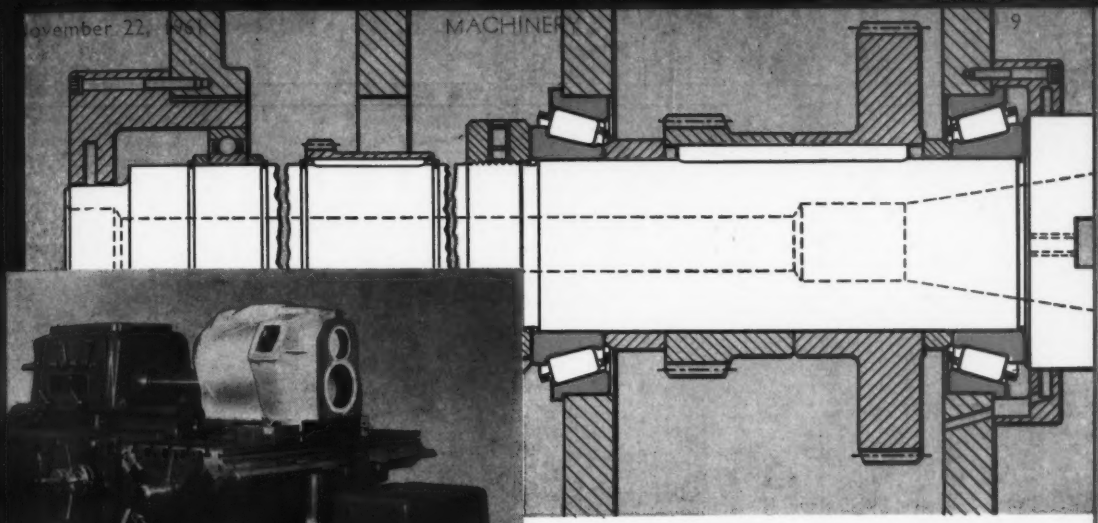

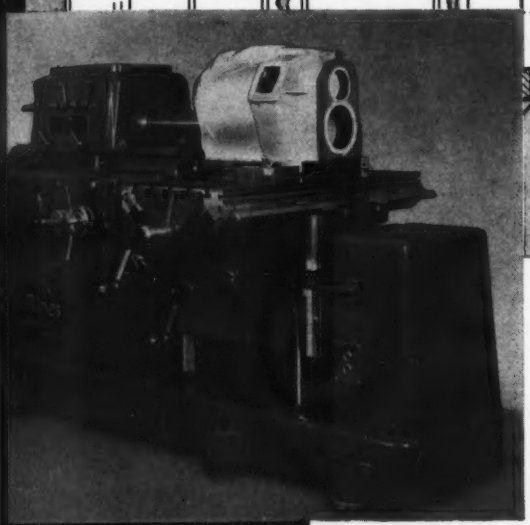

On the Milnes

HEAVY-DUTY FINE BORING MACHINE

BEARINGS OF GREAT ACCURACY

Fitted with high-precision 'double-zero' Timken bearings, this machine has exceptional accuracy.

Tests show how well it combines the qualities of heavy-duty and high precision: it will take roughing cuts up to ½" deep, yet produce work to a roundness of less than 'a tenth'—

$$\frac{8}{100{,}000}$$

This is a convincing demonstration of the value of high-precision Timken bearings, not only in their own internal accuracy but also in the way their flanged cups facilitate accurate machining of the headstock.

British Timken, Duston, Northampton, Division of The Timken Roller Bearing Company. Timken bearings manufactured in England, Australia, Brazil, Canada, France and U.S.A.

TIMKEN®

REGISTERED TRADE-MARK

tapered roller bearings

without changing blades

With the pitch of teeth progressing from 29 to 18 per inch along its length, this blade takes advantage of the natural sawing action.
The fine pitch lead-in reduces the effort required and minimises breakage, so often met when blades of incorrect pitch are being used.
Supplied in SPEEDICUT High Speed Steel and DIE-HARD Alloy Steel in 10″ and 12″ sizes at the same price as normal blades.

SPEEDICUT

PROGRESSIVE TEETH

HACKSAW BLADES

FIRTH BROWN TOOLS LIMITED

SPEEDICUT WORKS · CARLISLE ST. EAST · SHEFFIELD

1961

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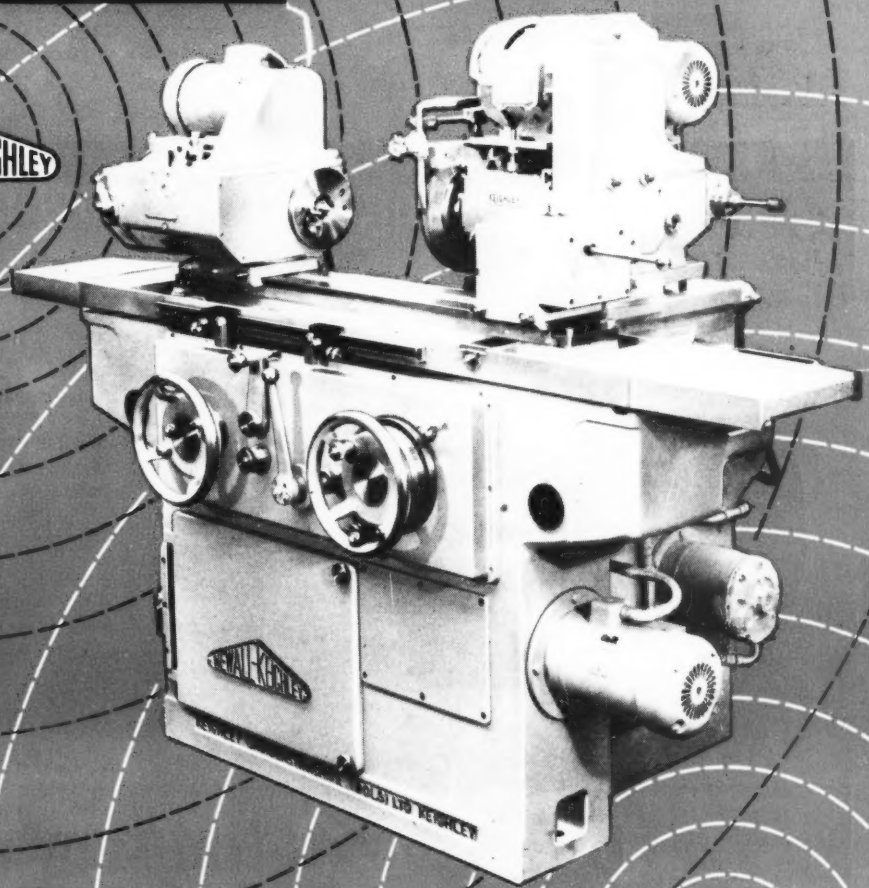
FIELD

KU 8

fully UNIVERSAL GRINDING MACHINE

5" centre height
20" max. grinding length

NEWALL-KEIGHLEY

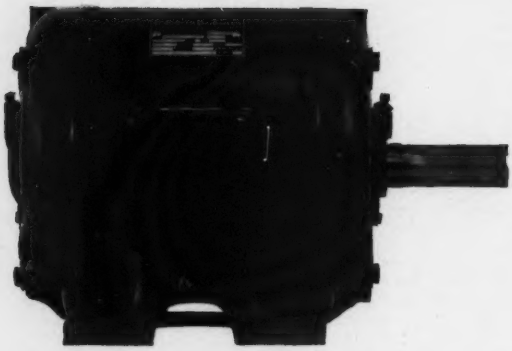


A HIGH-PRECISION COMPACT UNIT FOR TOOLROOM WORK OR SUPERFINE GRINDING

NEWALL GROUP SALES LIMITED

PETERBOROUGH TELEPHONE 3227-8-9 or KEIGHLEY TELEPHONE 4294

P 5289



You can usually divide the designing of any piece of equipment into two parts. The first—mainly theoretical—determining the basis of performance; the second—mainly practical—concerned with how the thing shall be made. Whereas the first proceeds from well-established principles held in common by all engineers, the second draws largely on the experience which has been accumulated over the years by a single manufacturer: his know-how. It is usually on this second aspect of design that the differences between one manufacturer's product and another's depends.

This thing called know-how

An interesting feature common to both ventilated (C range) and T.E.F.C. (D range) motors is the mounting of the stator pack. This is fully wound, impregnated and stoved. The stoving polymerises the varnish, making the winding highly resistant to oil, grease, humidity, salt spray and water. The stator pack, now a rigid unit, is pressed into the stator frame and located. This method of manufacture enables us to build a wide range of motors from stock parts and is one reason why we can quote good deliveries and *stick to them.*

Crompton Parkinson LIMITED

Makers of Electric Motors of all kinds, A.C. and D.C. Generators, B.T.H. Transformers, Switchgear, Cables, Instruments, Lamps, Lighting Equipment, Batteries, Stud Welding Equipment, Traction Equipment, Ceiling Fans.

CROMPTON PARKINSON LTD · CROMPTON HOUSE · ALDWYCH · LONDON · WC2

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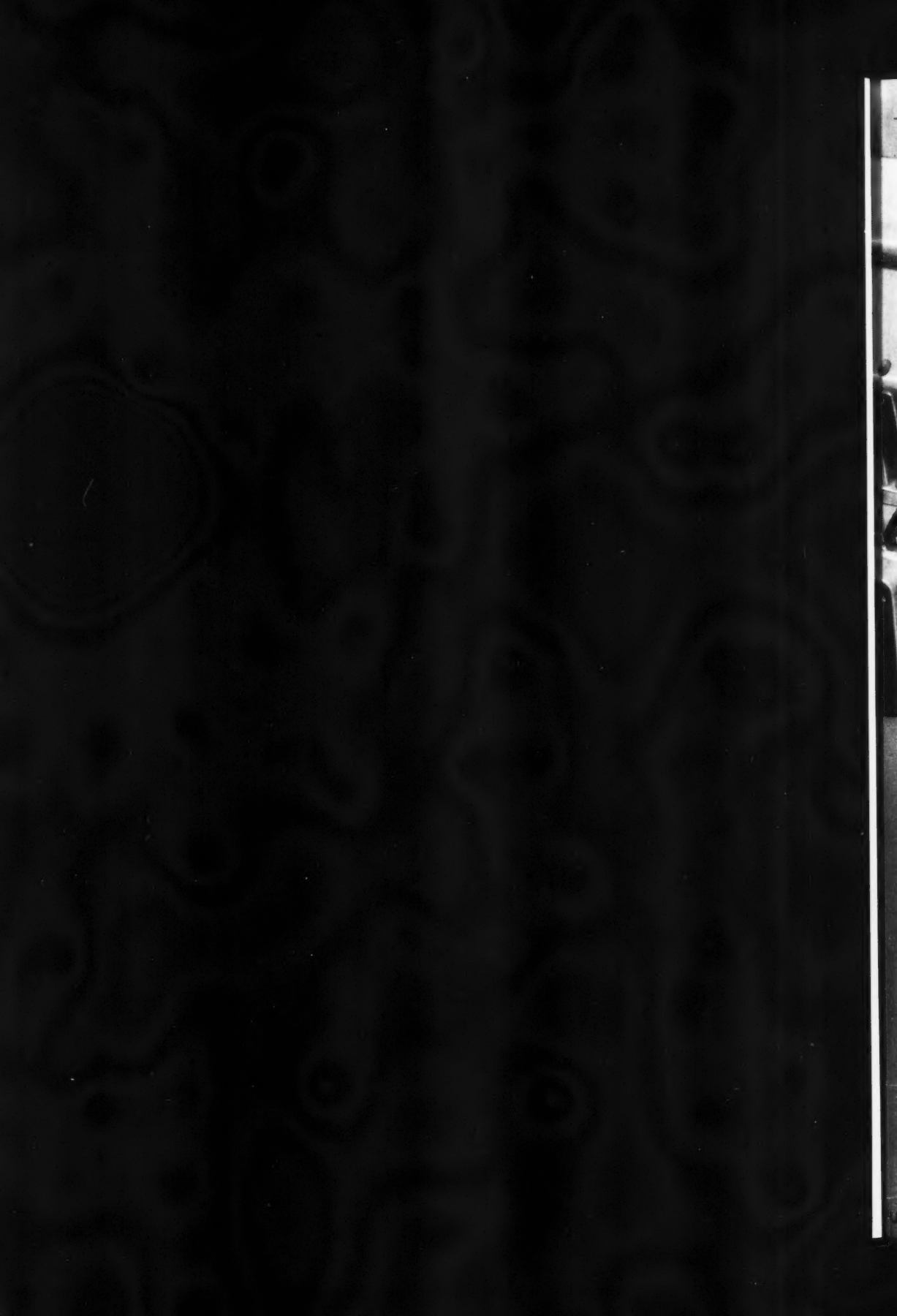
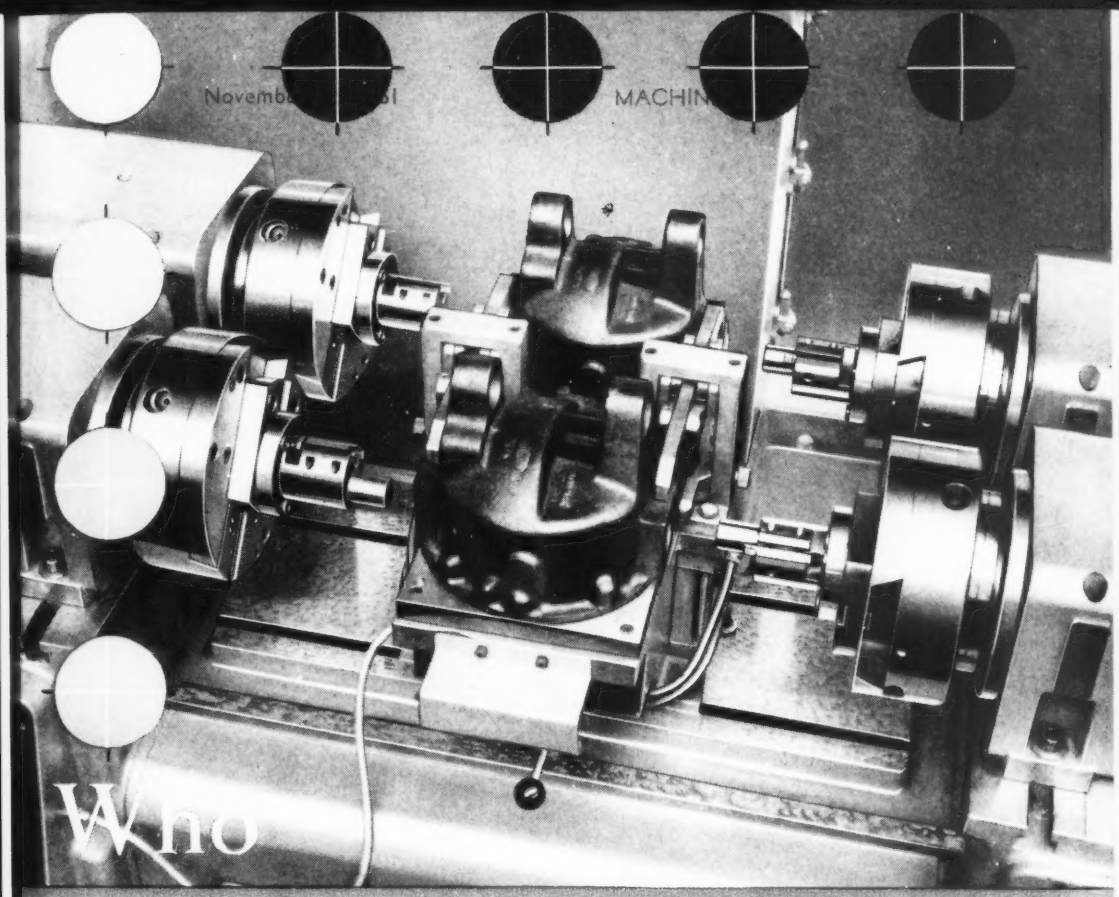
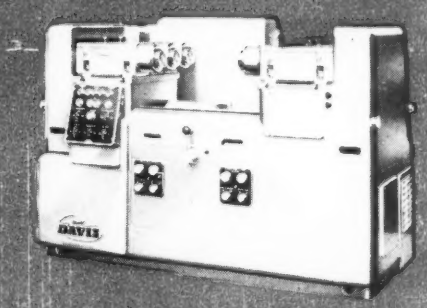




Who puts accurate space into holes?

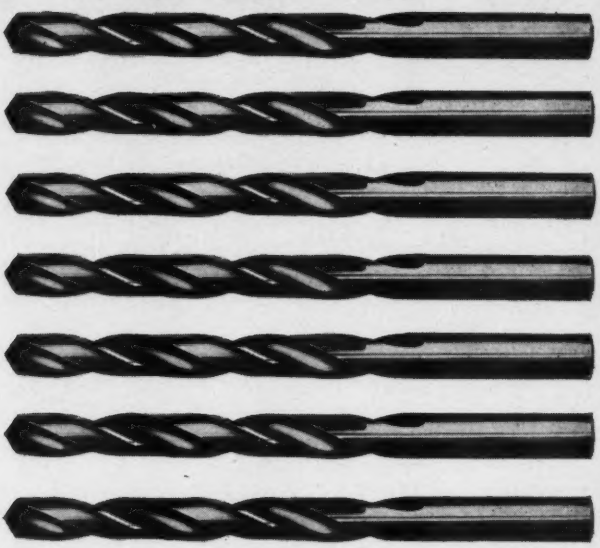
Stuart Davis do with their range of British designed and British made Fine Borers. Many production engineers have seen the wisdom of producing holes accurate to size and geometry on specialist machines—Fine Borers—instead of wasting time struggling to achieve the impossible on Capstans or Autos. Fine boring and turning is one process which produces holes, external diameters and faces to very close dimensional accuracy at really extraordinary speeds. A Fine Borer needs to be reliable in its feed rates, fast in responding to programme signals, versatile, and of course, consistently accurate in production. That is why many leading companies throughout the world have changed to Stuart Davis Fine Borers, a fitting tribute to British skill in design and manufacturing. The tooling illustrated produces rear axle casings boring to depth and generating inner and outer facings in a cycle time of 2 minutes.



Stuart DAVIS LTD

STUART DAVIS LTD., STONEBRIDGE HIGHWAY, WILLENHALL, COVENTRY. Tel: Toll Bar 2382/3

Clarkson



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(MACHINE TOOL DIVISION) PROSPECT IRONWORKS, LOCKWOOD, HUDDERSFIELD, YORKS

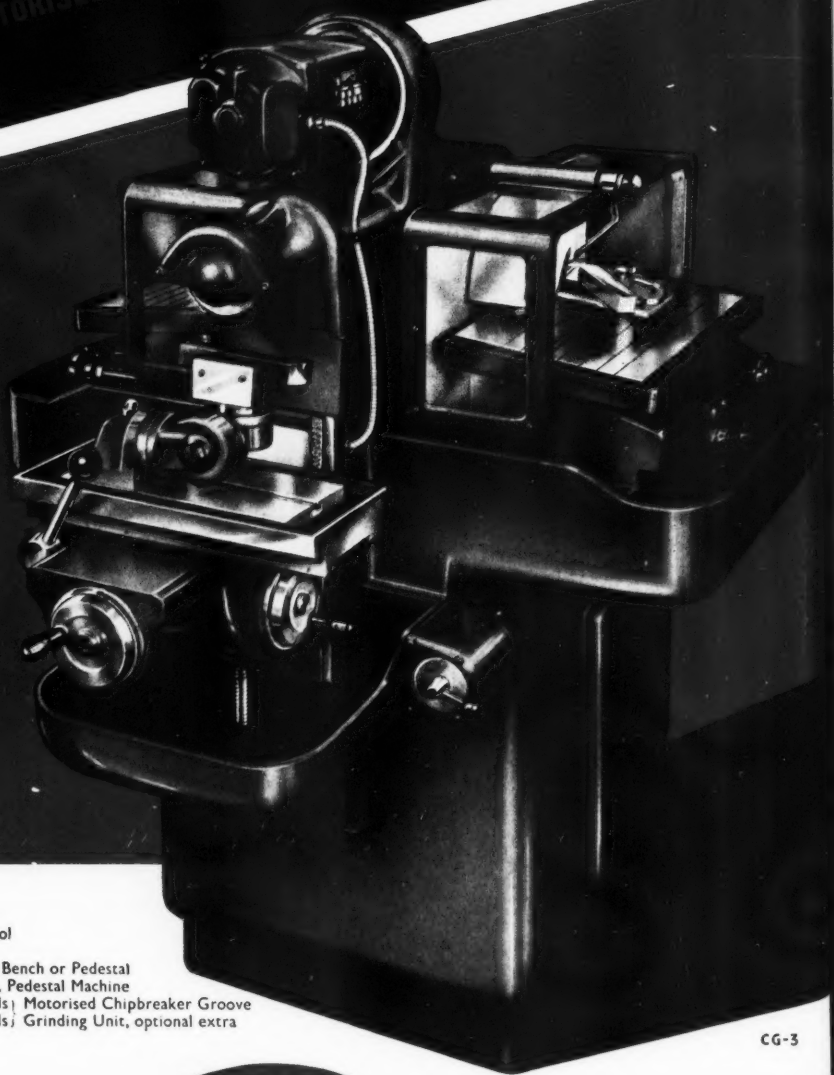
Telegrams : Drying, Huddersfield Telephone : Huddersfield 4410/1

makers of Machine Components since 1854

ABWOOD 'CONCENTRE' CARBIDE TOOL GRINDER

Model CG2A

WITH MOTORISED CHIP-BREAKER GROOVE GRINDING UNIT



- Constant centre height of table to grinding point irrespective of angle
- Adjustable taper roller bearings eliminate end float
- Perspex panelled spray guards provide perfect vision, hinged for easy access to wheel
- Uses diamond wheels to their maximum efficiency
- The Chipbreaker Groove Grinding Unit accommodates turning tools of most shapes and sizes

Our full range of Carbide Tool Grinding Machines includes:
Model CGO, 6 in. Wheels, Bench or Pedestal
Model CG1A, 8 in. Wheels, Pedestal Machine
Model CG2A, 8 in. Wheels } Motorised Chipbreaker Groove
Model CG3A, 12 in. Wheels } Grinding Unit, optional extra

CG-3

ABWOOD MACHINE TOOLS LTD., PRINCES ROAD, DARTFORD, KENT

Telephone : DARTFORD 25271 (5 lines) **Telegrams : ABWOOD, DARTFORD**

CG-3
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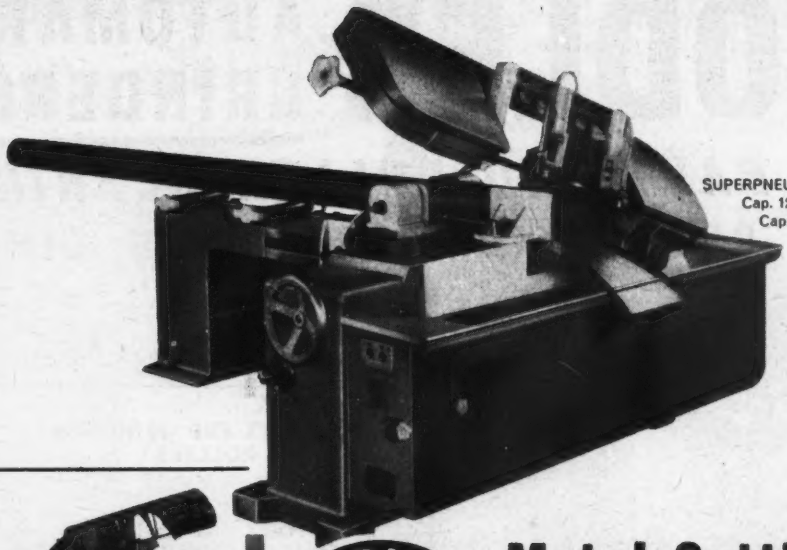


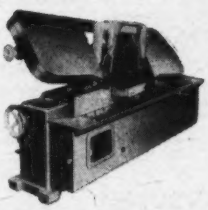
SUPERPNEUMATIC UP.2
Cap. 12" dia. normal.
Cap. 10" dia. auto.

PNEUMATIC UP.1
Cap. 8" dia. normal
Cap. 5½" dia. auto.

UPAM

Metal Cutting Bandsaws

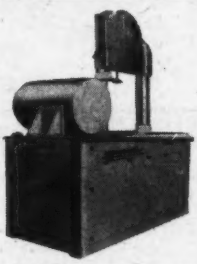
UP.1
Cap. 8" dia.
Cap. 8" x 16"
(Also UP.2
Cap. 12" dia,
24" x 24")



V.500 SWIVEL
Cap. 20" dia.
Cap. 20" x 20"

U.P.O.
Cap. 5½" dia
Cap. 5½" x 10"

V.500 FIXED
Cap. 20" dia.
Cap. 20" x 20"
(Also V.600
Cap. 24" dia.
24" x 24")



Built for maximum production from unskilled labour, UPAM Bandsaws offer a model for most needs. Automatic cycles models bring extra savings. All UPAM Machines can be relied on for hard work, precision cuts and continuous service. A leaflet is available.

Built for a Lifetime's Service!

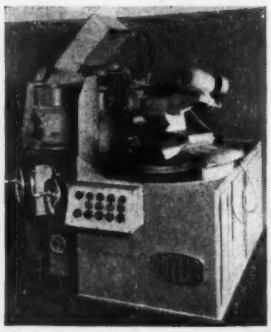
CATMUR MACHINE TOOL CORPORATION LIMITED

103 Lancaster Road, Ladbroke Grove, London, W.11. 'Phone PARk 9451/2

MODLER AUTOMATIC GRINDERS

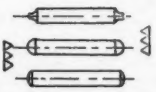
FOR BALL AND ROLLER BEARINGS

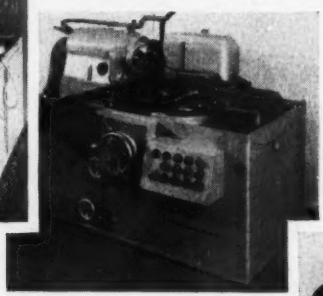
HIGH PRODUCTION—PRECISION LIMITS



MN 78 NEEDLE END GRINDING

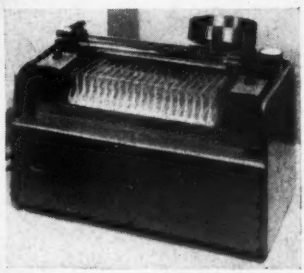
Both ends ground at one pass.
Length tolerance 0·002".
Production up to 10,000 per hour.





MRK 82 CONVEX END GRINDING TAPER ROLLERS
Production up to 4,000 per hour.

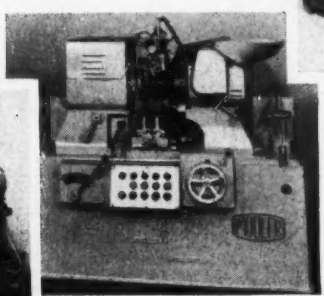
MR 77 CONVEX END GRINDING SPHERICAL ROLLERS
Production up to 1,200 per hour.

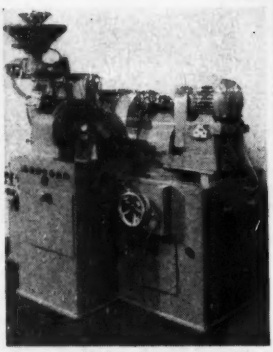


MKS 89 SORTING OR GRADING
Balls or Rollers up to ⅜" dia.

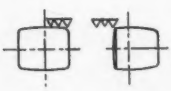
MKS 81 BALL FILING, GRINDING & LAPPING
For Balls up to 4mm. dia.
(not illustrated)

Always Selsons for Machine Tools

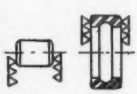




MT 75 SPHERICAL ROLLER GRINDING
Rollers up to 1" dia.
Roller radius ⅛" to 5".
Production up to 2,000 per hour.



MS 79 DOUBLE END GRINDING
Rollers up to 20mm. dia. Rings up to 60 mm. dia.
Squareness & Parallelism 0·00004". Production up to 10,000 per hour.



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THE SELSON MACHINE TOOL CO. LTD.

THE 600 GROUP OF COMPANIES

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STANNINGLEY Near LEEDS *Tel: Pudsey 2241*
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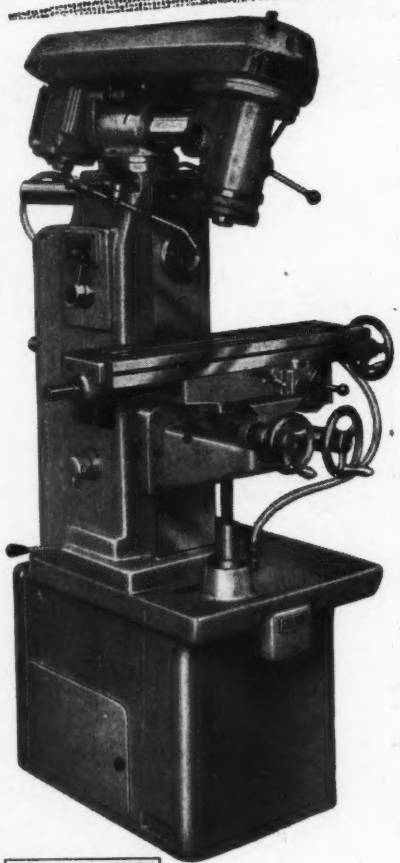
Selson MACHINE TOOLS

And at: Kingsbury (Nr. Tamworth), Manchester, Glasgow, Swansea, Newcastle-on-Tyne, Sheffield, Southampton, Belfast, Bath

Versatility with Economy!

VISIT THE ELLIOTT MACHINE TOOL EXHIBITION AT WILLESDEN, 11—15 DECEMBER

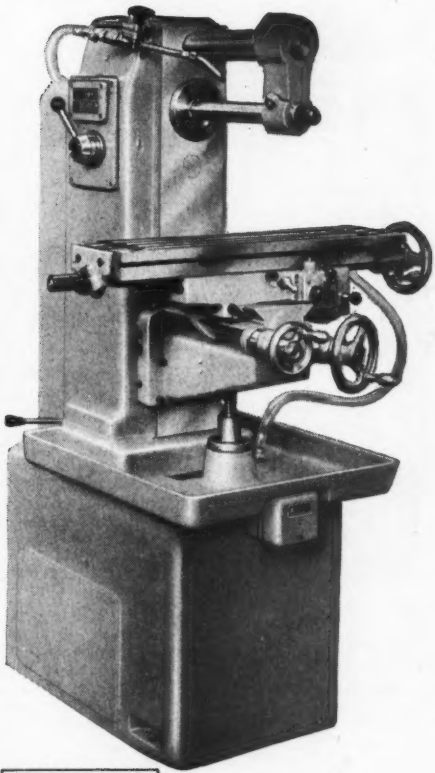
TWO IMPORTANT ADDITIONS NOW FIRMLY ESTABLISHED IN THE FAMOUS ELLIOTT-VICTORIA MILLING MACHINE RANGE



ELLIOTT VICTORIA

junior-OMNIMIL

- Ideally suited to small jig, tool, die and fixture work.
- 7 Vertical spindle speeds 200 - 3,600 r.p.m. Vertical head motor ¾ h.p.
- 8 horizontal spindle speeds 100-1700 r.p.m.
- 6 table feeds .009", .018", .036", .0018", .0036", and .0072".



ELLIOTT VICTORIA

juniormil

- Especially designed for economical and accurate milling of small components.
- Table size 28" x 7".

On Both Machines

- Working surface 28" x 7".
- Spindle motor 1 h.p.

Optical measuring equipment, dividing heads, slotting attachment and universal attachment available as extra equipment.

Manufactured by:

B. ELLIOTT (MACHINERY) LTD

(MEMBER of the B. ELLIOTT GROUP)
VICTORIA WORKS · WILLESDEN · LONDON · N.W.10
Tel: ELGAR 4050 (14 lines) Grams: Elliottens, Harles, London
Overseas Subsidiaries CANADA · U.S.A. · AUSTRALIA · S. AFRICA

ELLIOTT OF LONDON GROUP

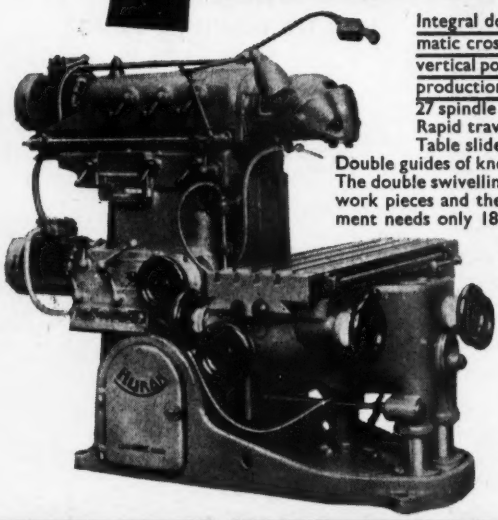
NRP 7750
B2

SLIDING RAM GIVES 27½in. AUTO CROSS FEED

HEAVY DUTY MILLING

ANGULAR COMPOUND HORIZONTAL VERTICAL

HURON SUPER UNIVERSAL MILLERS



Integral double swivelling universal head provided with 27½in. automatic cross feed by the sliding ram, can be set to the horizontal or vertical position, or to any angle instantaneously—permits the heaviest production cuts. Heads can be retracted completely from table line. 27 spindle speeds from 30 to 2,066 r.p.m., 27 feeds from $\frac{1}{16}$in. to 30in. Rapid traverses in all directions. All operating controls duplicated. Table slides directly in the knee without cross movement or swivel. Double guides of knee permit components in excess of 1½ tons to be machined. The double swivelling universal head requires an opening of only 14in. to enter work pieces and the whole sliding ram with its 27½in. automatic cross movement needs only 18in. clearance. OPTIONAL EXTRA FEATURES: Mounted spacing casting assemblies providing additional 8in. capacity under spindle. 26in. wide 8 T-slot tables and 39⅜in. automatic cross feed of sliding ram with special heavy duty knee and front operating position.

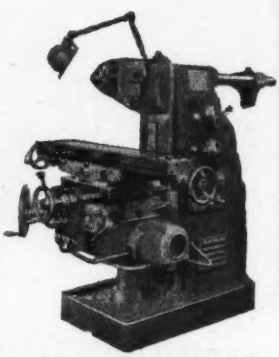
Type	Table	Automatic Feeds Long	Cross	Vert.
KU4	56½in. × 15⅞in.	43⅛in.	27½in.	19⅛in.
KU5	64½in. × 15⅞in.	51⅛in.	27½in.	19⅛in.
KU6	78⅛in. × 16½in.	59in.	27½in.	19⅛in.
KU55	64½in. × 26in.	51⅛in.	38⅛in.	18⅞in.
L83	157in. × 59in.	118in.	39⅜in.	59in.

HURON MU.6/FERRANTI 3-D MILLER

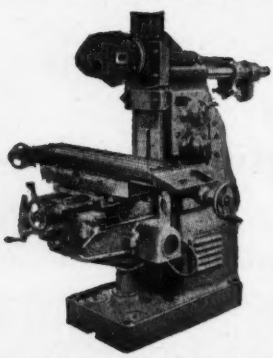
Type 'L' Open-side Traversing Head Universal Miller will mill, bore, slot and drill the largest work-pieces at one setting. The unique design permits greatest variety of operation on large work-pieces; the component remains stationary on the large work-table. Upright slides full length of base table and the sliding ram moves vertically and horizontally.

DUFOUR UNIVERSAL MILLERS

WITH DOUBLE UNIVERSAL SWIVELLING HEAD. RETRACTABLE SLIDE BRACKET AND SPACING CASTING GIVING 26" DAYLIGHT ON No. 59 AND 21" ON No. 61



FOR ALL MODELS Direct reading dial change for speeds and feeds. All parts subject to wear hardened and ground and completely interchangeable. Built to closest tolerances. Rapid traverses in all directions. Table swivels 30°. No. 40 taper for main horizontal spindle, double swivelling universal head, dividing head and rotary table. Hardened and ground centre guide for slideways. Twin overarms. Double swivelling sliding spindle heads with speeds 53-3000 r.p.m. Double swivelling universal head on retractable slide bracket providing with 5½in. Spacing Casting Drive assembly on 59 Machine 26in. daylight, and 21in. on No. 61.



MODELS 53 & 61. 16 universal head spindle speeds 21-1600 r.p.m.; 8 horizontal spindle speeds 21-1180 r.p.m.; 8 automatic feeds ½-18⅜in.

MODEL 59. 36 universal head spindle speeds 14-1780 r.p.m.; 12 horizontal spindle speeds 21-1180 r.p.m.; 16 automatic feeds ½-20in.

MODEL 54. Automatic cross feed of universal head 20in.; 18 universal head spindle speeds 12-1500 r.p.m.; 36 horizontal spindle speeds 6-1500 r.p.m.; 18 automatic feeds $\frac{1}{16}$-23⅜in.

Type	Table	Automatic Feeds Long.	Cross	Vert.
53	43⅜in. × 9⅜in.	27⅛in.	9⅜in.	15⅜in.
61	47½in. × 10⅜in.	30⅜in.	9⅜in.	15⅜in.
59	51⅞in. × 11⅜in.	34⅜in.	11 $\frac{11}{16}$in.	21 $\frac{1}{16}$in.
54	67in. × 14⅜in.	43⅜in.	14⅜in.	20⅜in.

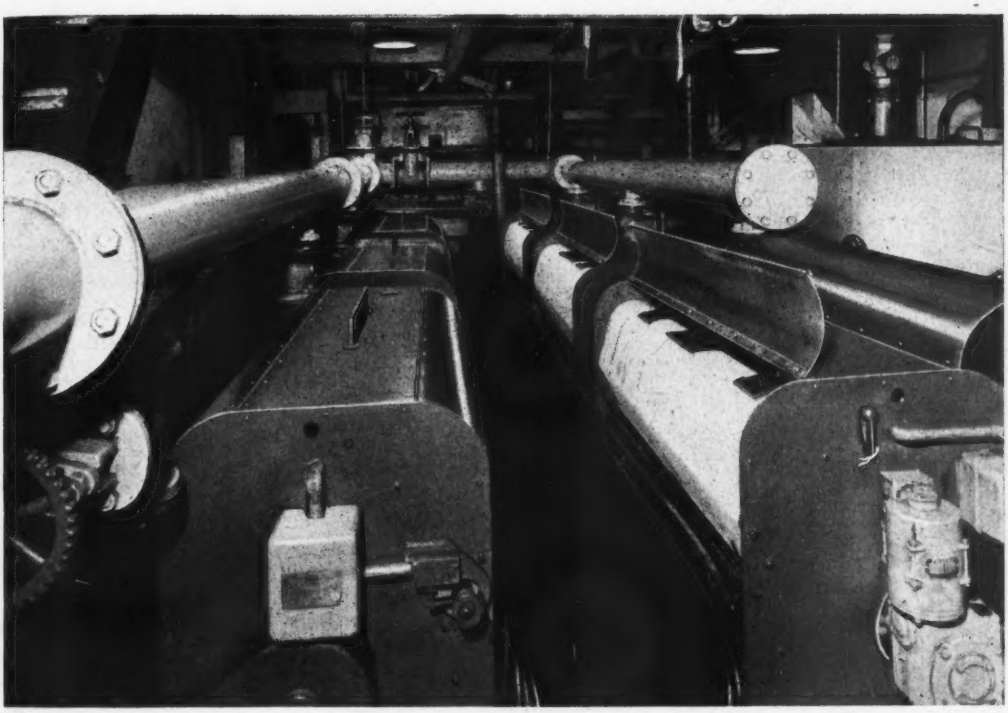
Send for full particulars of our very extensive range of these machines; ask for demonstration.

Rudolph Carne & Co. Ltd. SWAN WORKS, FISHERS LANE, CHISWICK, LONDON, W.4.

Tel: CHISWICK 0514, 6585 & 0337. Inland Telegrams: RUDCAR, CHISK, LONDON. Overseas Telegrams: RUDCAR, LONDON, W.4

THE STEEL COMPANY OF WALES

rely on MARBAIX SEPARATORS *for* CLEAN COOLANT...



This battery, installed at the Newport Division of The Steel Company of Wales Limited, consists of ten Model MP.25 Marbaix Fabric and Magnetic Filters.

Filters are mounted on a specially designed auxiliary tank which is valved to feed clean Coolant to either of two existing tanks.

Total Coolant flow is 30,000 gallons per hour.

Because of the satisfactory results obtained from this installation, a further and larger battery is being installed.

Photograph by courtesy of The Steel Company of Wales Limited.

GASTON E. MARBAIX LTD.

DEVONSHIRE HOUSE, VICARAGE CRESCENT, BATTERSEA, LONDON, S.W.11 Phone: Battersea 8888 (8 lines).

NRP 3608

EASIER STILL TO OPERATE WITH

Push-Button Controls

ALSO CONTROLLED ELECTRICALLY

- Start - Spindle drive motor
- Spindle drive motor Forward-Off-Reverse
- Lamp-brake ON
- Master Stop
- Lamp-supply ON
- Isolator-interlocked with hinged door

on the new

3N PARKSON MILLERS

PLAIN MILLER ILLUSTRATED

28 Spindle Speeds in range as selected. 17 to 1000 or 23 to 1330 or 25 to 1500 } r p m

TABLE

	Size		Movements	
	English (inches)	Metric (mm.)	English (inches)	Metric (mm.)
Plain	70 x 16½	1780 x 420	40 x 12 x 18	1015 x 305 x 455
Universal	60 x 14	1525 x 355	36 x 12 x 18	915 x 305 x 455

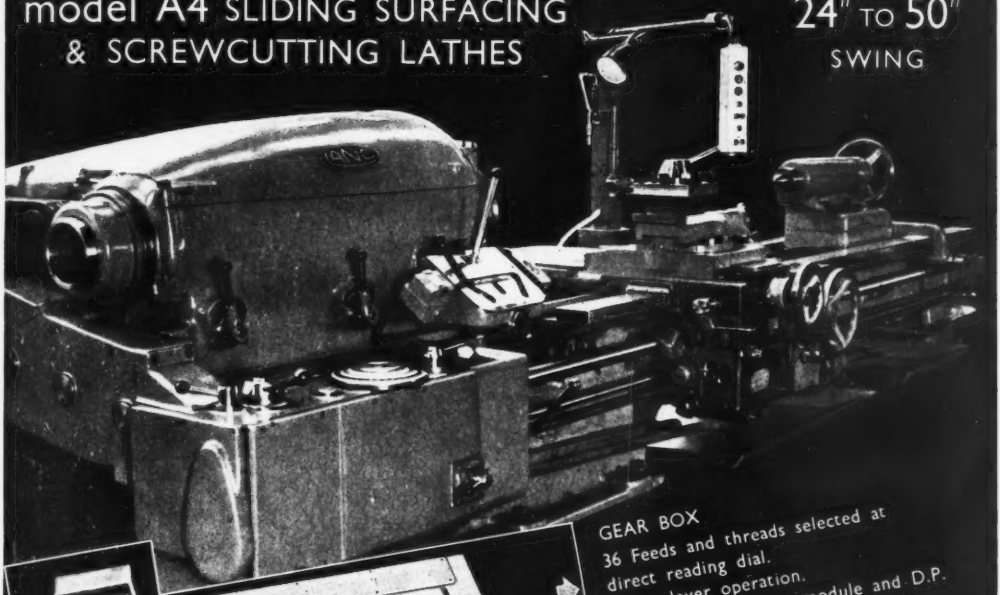
J. PARKINSON & SON (SHIPLEY) LIMITED
SHIPLEY YORKSHIRE ENGLAND
TELEPHONE SHIPLEY 53231

P. 389E

1961

model A4 SLIDING SURFACING & SCREWCUTTING LATHES

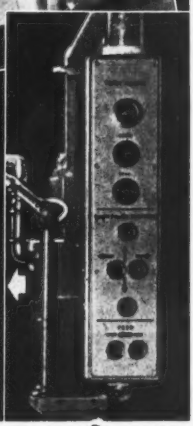
24" TO 50" SWING



GEAR BOX
36 Feeds and threads selected at direct reading dial.
Single lever operation.
Inch pitches, metric, module and D.P. also available.
Totally enclosed with all bearings and gears pump lubricated.

APRON
Totally enclosed with all gears and bearings pump lubricated.
Leadscrew nut automatically lubricated when closed.
Feed change allows feeds to be halved or doubled while cutting.
Feed engaged by push button operating magnetic clutches.

PUSH BUTTON PENDANT CONTROL
Set at the most convenient position for the operator and contains:
Feed, "on" "off."
Four directional quick power traverse.
Main motor, "start" "stop."
Warning lights.



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JOHNSTONE RENFREWSHIRE SCOTLAND
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ASSOCIATED BRITISH MACHINE TOOL MAKERS LIMITED
17 GROSVENOR GARDENS SW1

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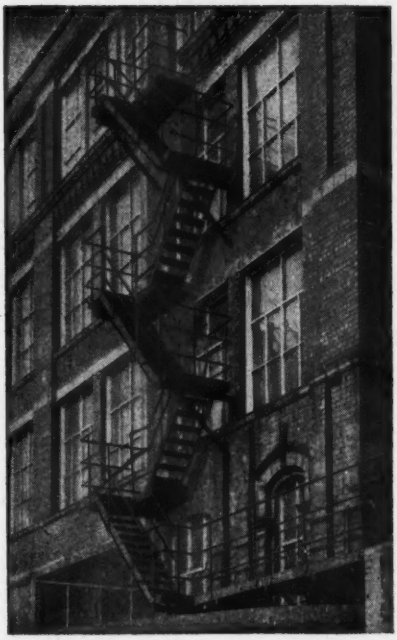
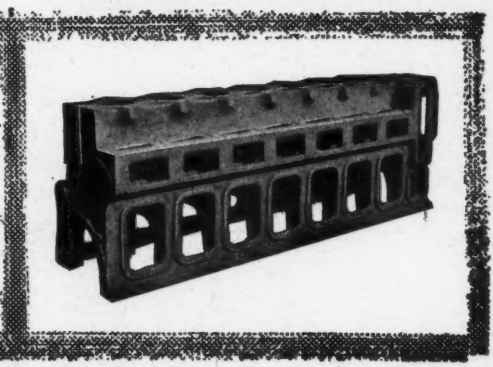
★ **HIGH DUTY ALLOY IRONS**

★ **FIRE ESCAPES**

With modern resources, backed by long years of experience, we are in a position to meet the most exacting demands for grey iron and high duty alloy iron castings up to the largest sizes. We can promise good deliveries and your enquiries will receive prompt and courteous attention.

FIRE ESCAPES, TOO . . . for many years we have specialised on this class of work and shall be glad to quote against your needs.





JOHN HALL & SON (OLDHAM) LIMITED

UNION IRON WORKS, CROSSBANK STREET, OLDHAM

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A "DRONSFIELD" ENTERPRISE

MATRIX QUALITY

British Built

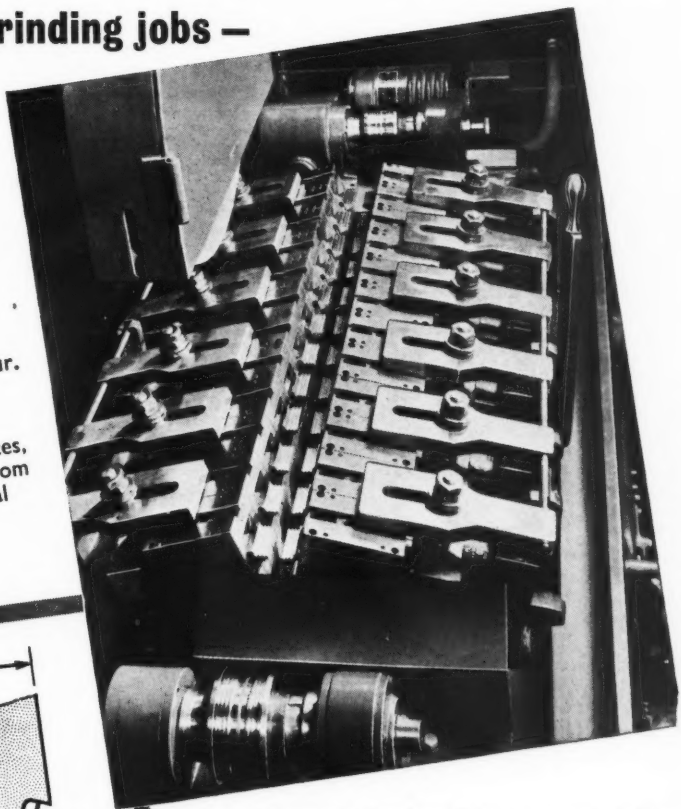
THOMPSON

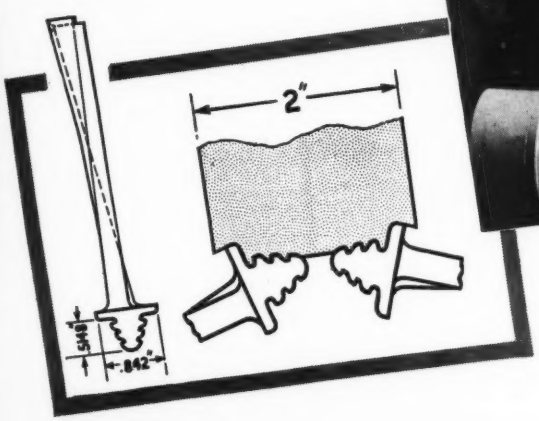
TRUFORMING GRINDERS

save time on form grinding jobs —

Manufactured by
Coventry Gauge & Tool Co. Ltd.

PART NAME: Jet Engine Blade.
METHOD OF HOLDING: 24 Place Fixture.
METHOD OF GRINDING: "Truforming" Two Rows (12 per row) from Solid — ·100 in. Stock Removal per Side.
MACHINE SIZE: Type "C" 12 x 16 x 44 Truform Grinder.
PRODUCTION: 33 pieces per hour.
NUMBER OF PIECES PER WHEEL DRESSING: 96.
CRUSHER ROLL LIFE: 864 pieces, before regrinding Work Roll from Reference Roll to restore initial accuracy.





Thompson Trueforming is an accurate and fast method of producing identical parts by transferring the shape or form of a preformed crushing roll first to the grinding wheel and then to the work. The crushing process produces a very free cutting wheel which gives an exceptionally high rate of stock removal.

It has many time-saving and product-improving applications, including the elimination of difficulties encountered in maintaining tolerances as grinding is carried out after hardening.

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MACHINE TOOL CO. LTD.

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Sheets from the Coil

-Accurate -Any length-Flat

McKAYMATIC Die Shear Lines

McKAY McK MACHINE

BRITISH BUILT BY VICKERS

McKAYMATIC DIE SHEAR LINES uncoil, level and cut to any length upwards of 9″ in a continuous operation. Cutting is effected by a flying shear synchronized with the material speed, precluding any strip damage. Sheet lengths and quantities are push button preselected, stopping the line being unnecessary when changing length. Punched cards enable automatic programming for different quantities of varying lengths. Very compact design with no pit—overall length of basic 48″ line including coil holder is only 21 feet. Save by using coiled material which is cheaper than sheet. Remember, special lengths do not involve extra cost and waste is reduced to the minimum.

INDISPENSABLE FOR STOCKHOLDERS AND LARGE USERS

ROCKWELL MACHINE TOOL CO. LTD.

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MK6

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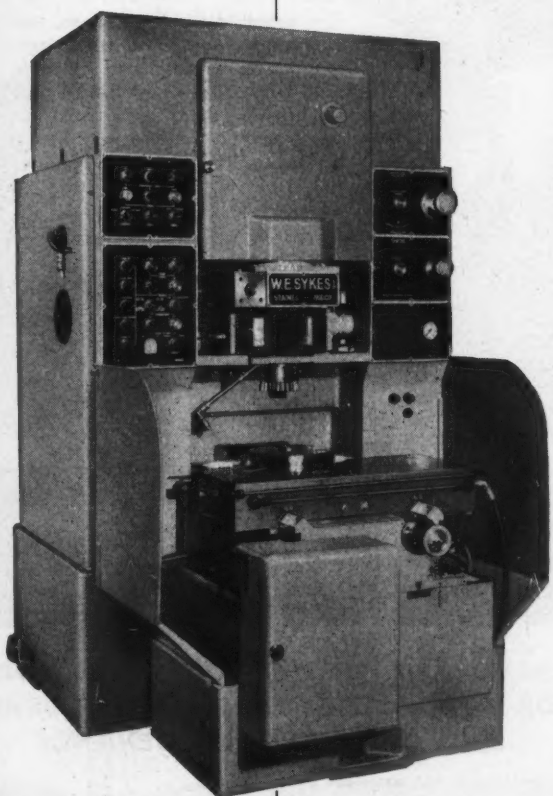
2822

V10 B

Talk to Sykes about the V10 B...

for jobbing or small batch production



The basic model V10B Vertical Gear Generator; the most practical approach to the problem of low cost, small batch, gear production. Not only reduces cutting times by up to 50% but increases machine utilisation by its exceptional simplicity of setting, operating and maintenance.
Robust construction with increased pitch capacity. Infinitely variable speeds and feeds. Hydraulic Infeed with switch selected 1, 2 or 3 cuts. Faster infeed; no cams to adjust. Rapid saddle traverse with adjustable drop-off. Adjustable off-set saddle for maximum feed rates. Setting time cut by one third. Ample reserve of hydraulic power for work clamping. Foolproof operation.
PLUS... An extensive range of optional equipment and accessories.

If you would like to know more about the V10B for jobbing or small batch production, write for a copy of brochure P18/60.

SYKES

W. E. SYKES LIMITED · STAINES · MIDDLESEX · ENGLAND
and associated companies:
Sykes Tool Corporation Ltd., Windsor, Ontario, Canada. Sykes Machine & Gear Corporation Detroit, Michigan, U.S.A. W. E. Sykes Ltd., Mascot, Sydney, NSW, Australia.

The World's most advanced capstan lathe

The latest MURAD capstans, successors to a well-proven range, embody many advanced developments counting towards better and faster production. Controls, for instance, are finger light and at the correct height for the operator making possible greater output every hour of every day without fatigue.

Write to-day for complete details of these unique machines.

FAVOURABLE DELIVERIES

MODEL 3Q (Illustrated)

Max. Collet Capacity ...	¾"
Spindle Nose to Face of Turret	12½"
Swing Over Cross Slide	4½"
Swing Over Bed	11½"
Four Speed Ranges:	
'A'	350/4,800 r.p.m.
'B'	225/3,110 r.p.m.
'C'	150/1,940 r.p.m.
'D'	85/1,030 r.p.m.

MODEL 1 STANDARD

Max. Collet Capacity ...	1"
Spindle Nose to Face of Turret	12½"
Swing Over Cross Slide	4½"
Swing Over Bed	11½"
Speed Range as for Model 3Q	

Please write for full technical details of the above and other models, including the 1A, 1B, VELOMATIC and 3C.

The **Murad**

UNEXCELLED THROUGHOUT THE WORLD FOR PRODUCTIVE CAPACITY, ACCURACY AND OPERATING CONVENIENCE

Write to-day for complete details.

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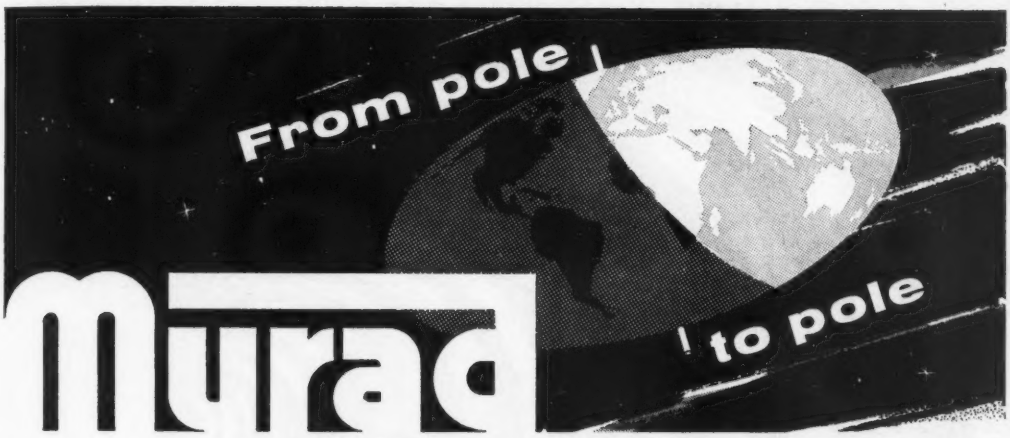
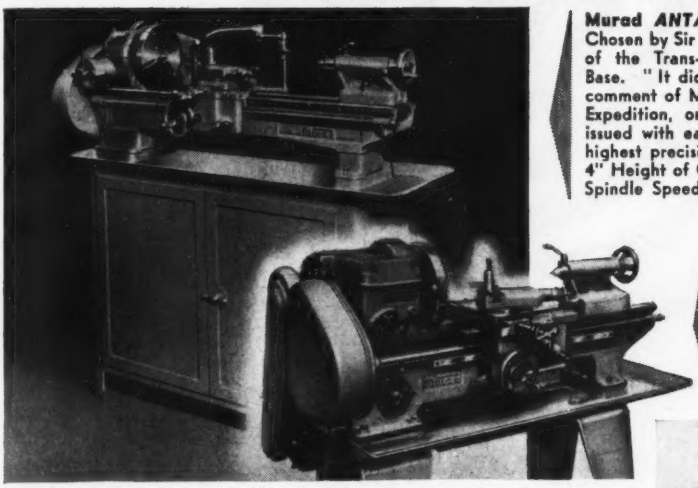


Murad

A GREAT NAME IN TURNING

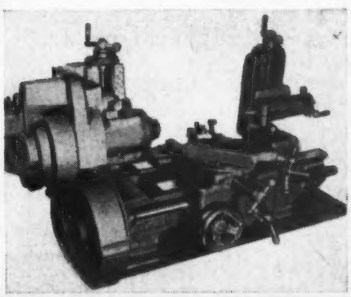


Murad *ANTARCTICA* Precision Lathe
Chosen by Sir Vivian Fuchs to service the equipment of the Trans-Antarctic Expedition at Shackleton Base. "It did everything we asked of it," was the comment of Mr David Pratt, Chief Engineer of the Expedition, on his return. A Test Certificate is issued with each machine showing it to be of the highest precision.
4" Height of Centres, 18" or 24" between Centres.
Spindle Speeds 40 - 1,600 r.p.m.

The Cadet
All geared head centre lathe. It was chosen for the R.N.Z.N. Ship "Endeavour" which serviced Sir Edmund Hillary's part of the Trans-Antarctic Expedition at Ross Bay.
4" Height of Centres, 18" or 24" between Centres.

Get the details of these well proven machines . . today

The Bormilathe
An outstandingly versatile machine, is an entirely new type of Machine Tool capable of carrying out boring, milling and turning and every type of wood-working. A Bormilathe is now on its way to the Arctic Region for the use of an Expedition by the Canadian Department of Northern Affairs and National Resources.
From Pole to Pole, men who direct great enterprises choose Murad.



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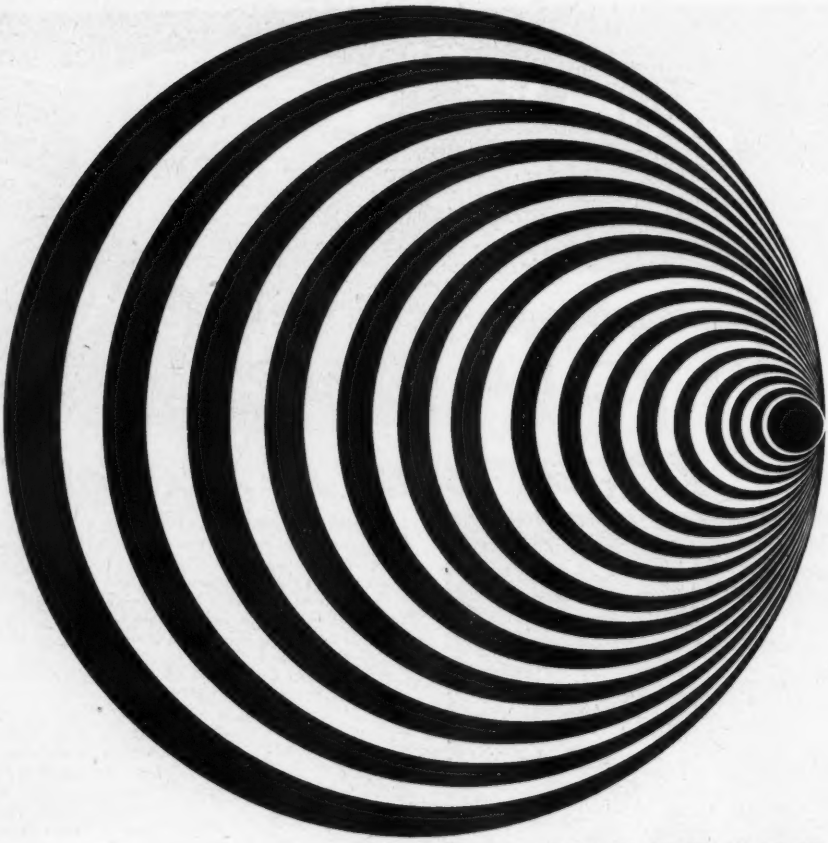

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PRODUCTION
CAPACITY

Automatic or semi-automatic machinery increases production and reduces costs, and Martonair pneumatic equipment has been the means of building thousands of machines. Low cost, adaptability and simplicity are special features of Martonair products. If there is no machine available for the operation you wish to mechanise, or existing machines are for some reason unsuitable, it may well be possible to build a simple special purpose machine. The Martonair Technical Service is at your disposal at all times, and has considerable experience of the applications of pneumatics in industry.

Martonair

MARTONAIR LIMITED, PARKSHOT, RICHMOND, SURREY, ENGLAND.
. . . AND AT BIRMINGHAM · CARDIFF · GATESHEAD · GLASGOW · SHEFFIELD · AUSTRALIA
BELGIUM · CANADA · DENMARK · FINLAND · GERMANY · HOLLAND · ICELAND · ITALY
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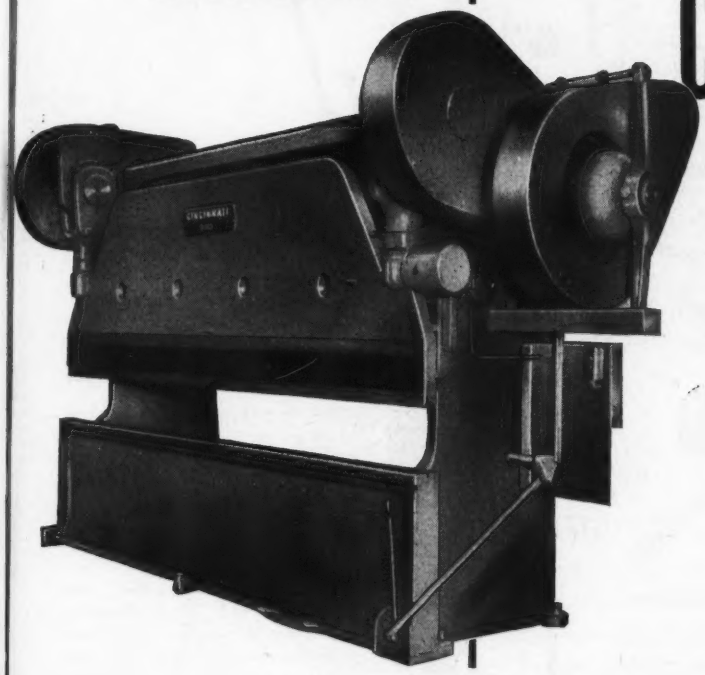
Built to Precision Machine Tool Standards

CINCINNATI

BRITISH BUILT CINCINNATI all steel PRESS BRAKES

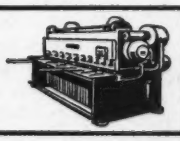


The all-steel interlocked construction, centreline loading and deep beds and rams give maximum rigidity

. . . rigidity means accuracy

. . . AND BRITISH MADE

CINCINNATI *all steel* SHEARS



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CINCINNATI OFFER A COMPREHENSIVE DIE DESIGN SERVICE

E. H. JONES (MACHINE TOOLS) LIMITED

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Telephone: HOVE 37253 Telegrams: Garantools, Portslade

LONDON · BIRMINGHAM · GLASGOW · MANCHESTER · BRISTOL

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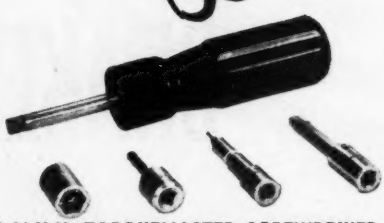
AVOID CARELESS TORQUE



THE M.H.H. TORQUEMASTER SCREWDRIVER

The control of torques below 2 lbs/inches is now possible outside the laboratory with this tool which can be pre-set to any specified loading between 8 oz./inches and 36 lbs./inches (with 'specials' up to 100 lbs./inches) thereby avoiding the wastage of both time and materials due to stripping threads and distorting components.

TORQUEMASTER DIAL SETTING RIG

An instrument for adjusting screwdriver to the Torque required.

CONTROL SMALL TORQUE

M.H.H. TORQUEMETER

Tightens Nuts and Bolts precisely — accurately securely

18 Models ranging from 3 lbs./inch to 1500 lbs./foot

The M.H.H. Torquemeter wrench is a precision tool for all assemblies, used in conjunction with M.H.H. Standard Nut Sockets it will provide the simplest solution to any problem requiring the measurement of torque.

Double-ended spindles are provided and it is therefore, possible to undo right hand threads and also do up left hand threads to the pre-determined load.

Each Model covers a wide range of torque loadings without the need for any setting equipment and is guaranteed to an accuracy of plus or minus 3% throughout its effective range.

English or Metric Dials.

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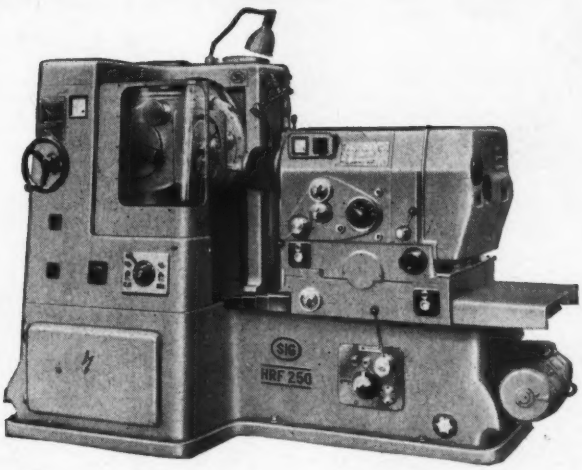
M.H.H ENGINEERING CO. LTD. BRAMLEY·GUILDFORD SURREY

Tel: Bramley 2248

For *Rapid* Accurate Cam Milling...



SWISS S.I.G.

HYDRAULIC CAM MILLER MODEL HRF 250

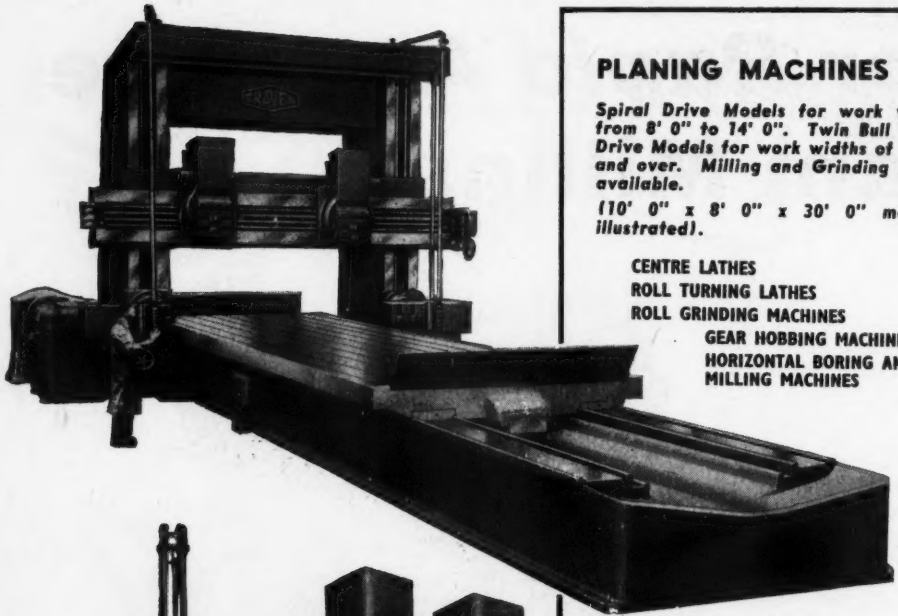
All types of cams—plate cams, track cams, face, cylindrical and special cams, irregular forms—and tracks up to 8 convolutions—can be copied accurately and economically from simple sheet steel masters. Hydraulic longitudinal feeds and rapid traverse. Face plate speeds steplessly variable ·016 to 2 r.p.m. 13 milling spindle speeds 100 to 1600 r.p.m. or alternatively stepless speeds 100 to 2000 r.p.m. A hydraulic device for roller offset compensation is available and, for hardened cams, grinding attachments giving wheel speeds up to 15,000 or alternatively up to 24,000 r.p.m.

Maximum diameter: plate cams 12", cylindrical cams 14".
Maximum height cylindrical cams 10".

Send for brochure M/210 from the Sole U.K. Distributors

DOWDING & DOLL LTD
346 KENSINGTON HIGH STREET, LONDON, W.14
Tel: WESTERN 8077 (8 lines) Telex: 23182 Grams: ACCURATOOL LONDON TELEX

210

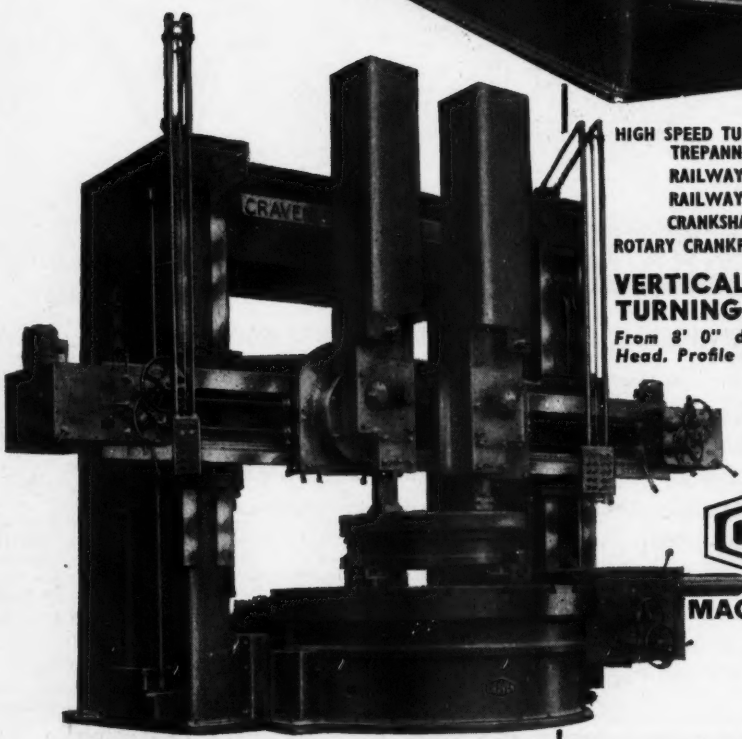


PLANING MACHINES

Spiral Drive Models for work widths from 8' 0" to 14' 0". Twin Bull Wheel Drive Models for work widths of 16' 0" and over. Milling and Grinding Heads available.

(10' 0" x 8' 0" x 30' 0" machine illustrated).

CENTRE LATHES
ROLL TURNING LATHES
ROLL GRINDING MACHINES
GEAR HOBBING MACHINES
HORIZONTAL BORING AND MILLING MACHINES



HIGH SPEED TUBE BORING AND TREPANNING MACHINES
RAILWAY WHEEL LATHES
RAILWAY AXLE LATHES
CRANKSHAFT LATHES
ROTARY CRANKPIN MACHINES, ETC.

VERTICAL BORING AND TURNING MILLS

From 8' 0" diameter capacity. Side Head, Profile Copying, Rotary Planing, Pre-selection of speeds, Constant Cutting Speed Control, etc. available. (10' 0" Mill illustrated).

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MACHINE TOOLS

CRAVEN BROTHERS (MANCHESTER) LIMITED

VAUXHALL WORKS, REDDISH, STOCKPORT, ENGLAND

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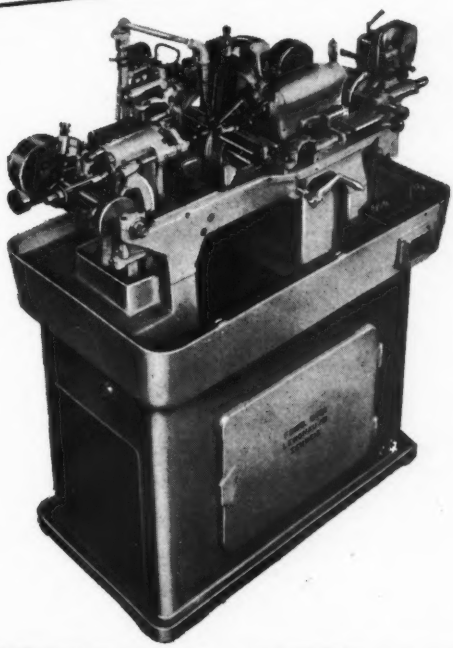
GYGI

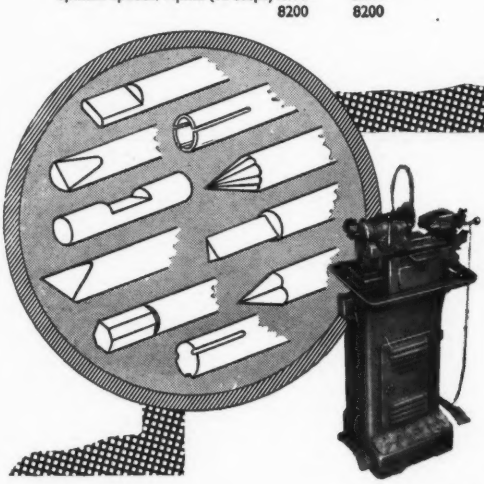
Precision Turning and Screw Cutting Automatic

For simplicity of set-up with high output.

This Swiss high-precision sliding head automatic is suitable for the economic manufacture of turned and screwed parts in small or large quantities The standard cams cover the great majority of the machine's possible operations, so that change-overs are speeded up by eliminating cam-making. Thus the machine has the flexibility and easy set-up of the capstan combined with the high output of the automatic. 3, 4, or 5 tool slides are available, and the machine's versatility is further increased by interchangeable end-working attachments for slotting, drilling, undercutting, copying, tapping and threading, either right-or left-hand, up to the maximum bar capacity of the machine.

Brief specification :-		GL 16/7	GL 16/10
Maximum bar capacity,	round	17/64"	25/64"
	hexagon, A/F	15/64"	23/64"
	square, A/F	13/64"	17/64"
Maximum length turned ...		2"	2"
Maximum diameter threaded, M.S.		17/64"	17/64"
Spindle speeds, r.p.m. (16 steps)		2800–8200	2800–8200





Multiple Flat Milling or Grinding Machine

A semi-automatic multi-purpose machine for performing second-operation grinding or milling, in-feed, longitudinal and conical, on components up to $\frac{3}{8}$" diameter Rapid loading and unloading assures economical batch or series production.

Brief specification :-	GL 17
Maximum bore of collet .	$\frac{3}{8}$"
Maximum diameter of work...	11/32"
Maximum length machined ..	$1\frac{3}{4}$"

WICKMAN LIMITED

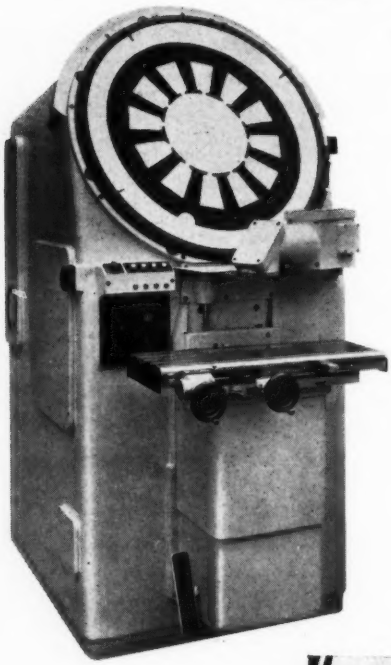
FACTORED MACHINE TOOL DIVISION, BANNER LANE, COVENTRY

Telephone : Tile Hill 65231.

523 F 18/61

C

HAUSER



When precision is important — but space is at a premium, the

The P.750 PROFILE PROJECTOR

provides the answer

This recent addition to the Hauser range incorporates big-screen projection in compact form. Designed around a vertically arranged optical system it enables many types of specimens to be applied without holding fixtures. Five degrees of magnification are provided, 10X, 20X, 30X, 50X and 100X with episcopic or diascopic projection, magnification and work-table height being selected by push-buttons. Table clearance permits the inspection of bulky workpieces. The large projection screen is calibrated with angular readings on vernier of one minute of arc for angle measurement.

Specification:

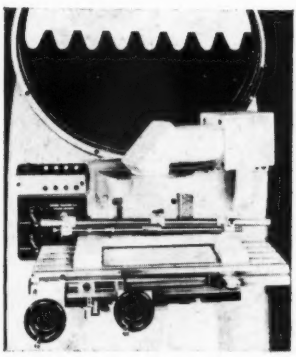
Work table area
25⅝ in. x 8⅞ in.

Longitudinal travel (adjustment by micrometer screw, dividing drum and gauge blocks,
8 in.

Transverse travel
3½ in.

Clearance, table to condenser
12 in.

Vertical travel of table
6 in.



The range of accessories includes: combination tail stocks and vee blocks for holding turned parts; tiltable support with centres for inspection of threads; and a gear checking device for the examination of small gear tooth meshing.

Sole Agents:

WICKMAN LIMITED

FACTORED MACHINE TOOL DIVISION
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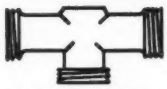
Wickman Moulton Thread Milling Machines



1 7/16" dia. Hob. 6 TPI, R.H.
Cutter Spindle Speed, 210 r.p.m.
Work Spindle Speed 3—5 m.p.r.
Material : Stainless Steel.

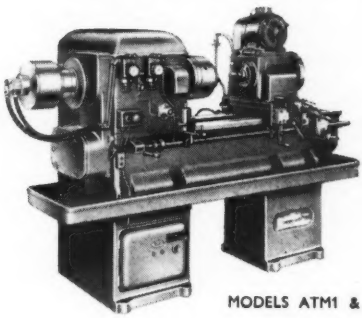
2" dia. Hob, 3 TPI
Acme thread, R.H.
Cutter Spindle Speed,
185 r.p.m.
Work Spindle Speed,
23 m.p.r.
Material :
Steel forging.

1½" dia. Hob, 1·75 TPI. Special form, L.H.
Cutter Speed, 185 r.p.m.
Work Spindle Speed, 5 m.p.r.
Material : Steel.

3" dia. single Cutter, Acme thread, ½" pitch, 12 Splines.
Cutter Spindle Speed, 122 r.p.m.
Lateral cutting speed, 2" p.m.
Material : EN.8.

3" dia. single Cutter, Acme thread, ½" pitch, R.H., Helix angle 3°—26'
Cutter Spindle Speed, 122 r.p.m.
Work Spindle Speed, 2 m.p.r.
Material : EN.8.

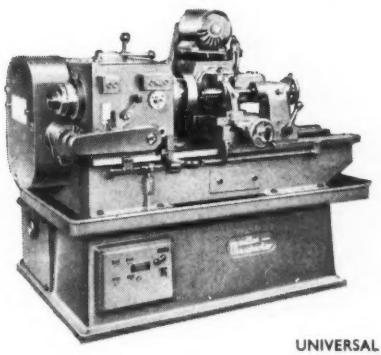
3" dia. single Cutter, Acme thread, ½" pitch, R.H., Helix angle 4°—55'
Cutter Spindle Speed, 122 r.p.m.
Work Spindle Speed, 3 m.p.r.
Material : EN.8.



MODELS ATM1 & ATM2

The Range of Wickman Moulton machines is designed for the milling of internal and external threads up to 12 ins. diameter on workpieces up to 30 ins. long on standard machines, automatically.
The ATM models are suitable for short threads normally produced with multi-form cutters in a single revolution of the work.

The Universal model will produce, in addition, longer threads and taper threads of any form with single cutters. The machine will also mill straight splines.



UNIVERSAL MODEL

WICKMAN LIMITED

FACTORED MACHINE TOOL DIVISION, BANNER LANE, COVENTRY

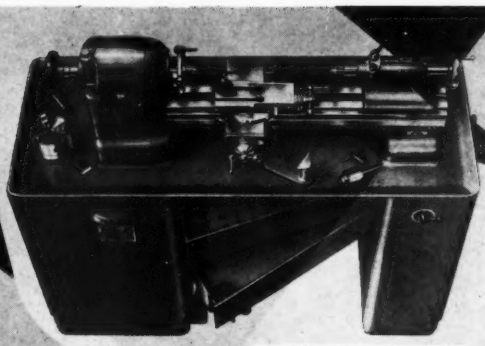
Telephone : Tile Hill 65231

F.583

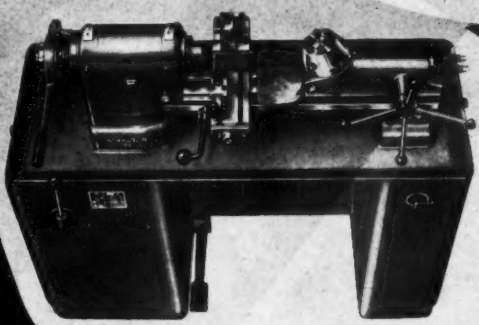
SCHAUBLIN

Precision Toolmakers Lathes, Turret Lathes and Second Operation Lathes are the most versatile, small precision turning machines built.

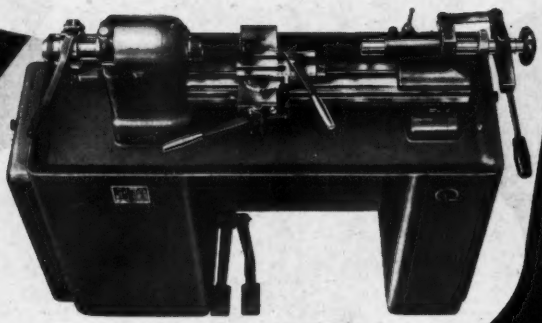
Their famous quality and dependability assure the highest standards of accuracy throughout a long and busy life. If you do not already know them, ask us for information.



Precision Toolmakers Lathe



Turret Lathe



Second Operation Lathe

SCHAUBLIN 102

WICKMAN LIMITED

FACTORED MACHINE TOOL DIVISION, BANNER LANE, COVENTRY

Telephone: Tile Hill 65231

F.586

*From General Electric Company, U.S.A.**

General Electric Man-Made diamond for grinding wheels in all three bonds

Wheels using General Electric's Man-Made diamond offer important advantages in industrial grinding. They are uniform in shape and structure and give consistent grinding performance. There are special crystals for resinoid, vitrified and metal bonds. Wheels with G-E Man-Made diamond provide a maximum output and are superior to wheels equipped with natural diamond. For further information, contact your wheel supplier and ask for wheels made with General Electric Man-Made diamond; or write International General Electric Co. of New York, Ltd., Lincoln House, 296-302 High Holborn, London W.C.1, England.

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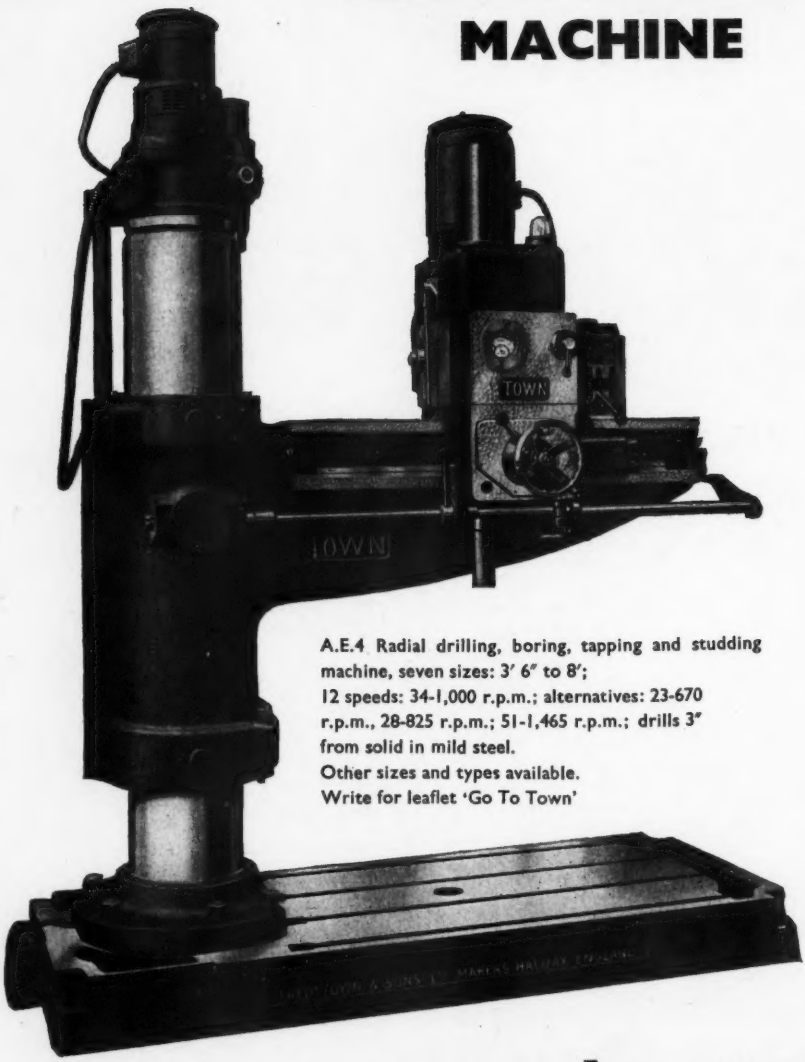
U.S.A.

**General Electric Company, U.S.A., is not connected with the British company of the same name.*

TOWN

RADIAL DRILLING MACHINE



A.E.4 Radial drilling, boring, tapping and studding machine, seven sizes: 3′ 6″ to 8′;
12 speeds: 34-1,000 r.p.m.; alternatives: 23-670 r.p.m., 28-825 r.p.m.; 51-1,465 r.p.m.; drills 3″ from solid in mild steel.
Other sizes and types available.
Write for leaflet 'Go To Town'

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Makers of high class Drilling Machines for 58 years.
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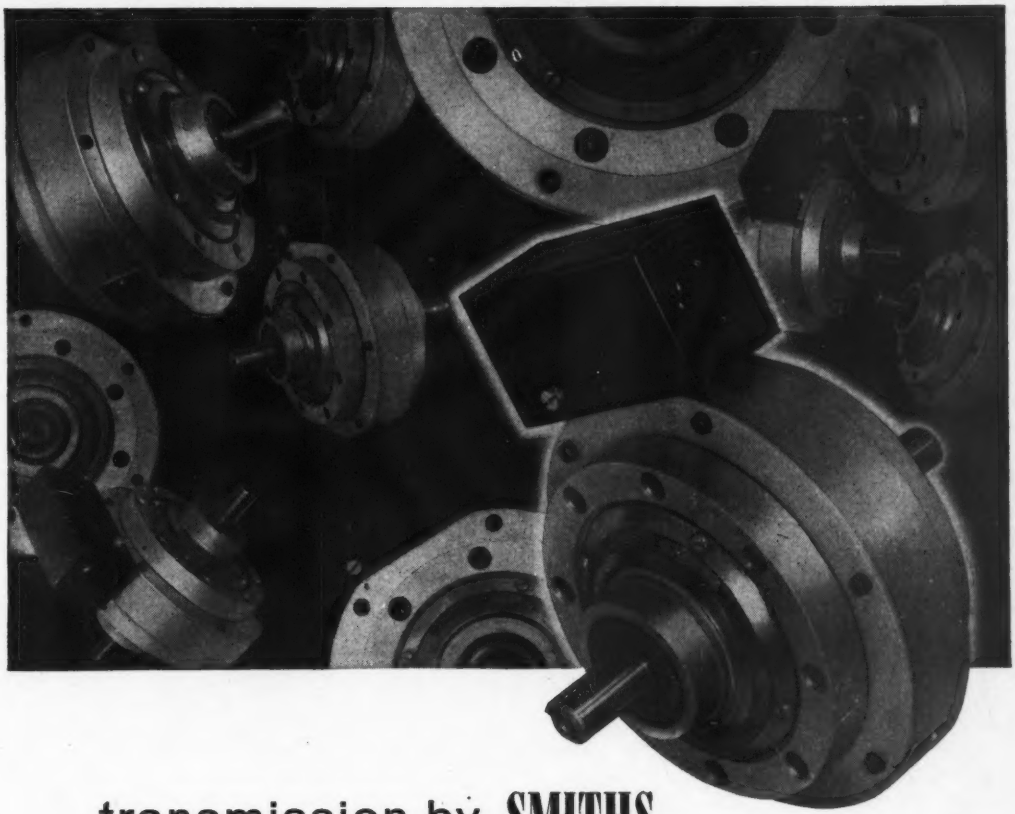

transmission by SMITHS

Wherever accurate speeds and the precise control of torque and tension are essential, the Magnetic Particle Coupling developed by SMITHS Industrial Division provides a uniquely simple and sensitive means of transmission. In the reeling of such varied materials as wire, plastic sheet, tube or fibre, paper, rubber, metal sheet and textiles, and in such processes as extrusion, automatic plating, dyeing, annealing, impregnating and printing, its advantages have been quickly recognised. Other possible uses are innumerable—if you have a torque transmission problem, the versatility of SMITHS Magnetic Particle Coupling may well supply the answer. May we send a Technical Representative to see you ?

Some features of SMITHS Magnetic Particle Couplings:

- Infinitely variable electrical torque control
- Positive drive entirely without slip, or with controlled slip
- Coupling or braking action in either direction
- Reliable torque limitation
- No slip rings: excitation coil is stationary
- Smooth operation — torque proportional to energising current
- Eight sizes (torque capacities from 0.5 lb./ft. to 200 lb./ft.)

SMITHS INDUSTRIAL DIVISION

The Industrial Division of **S. Smith & Sons (England) Ltd**

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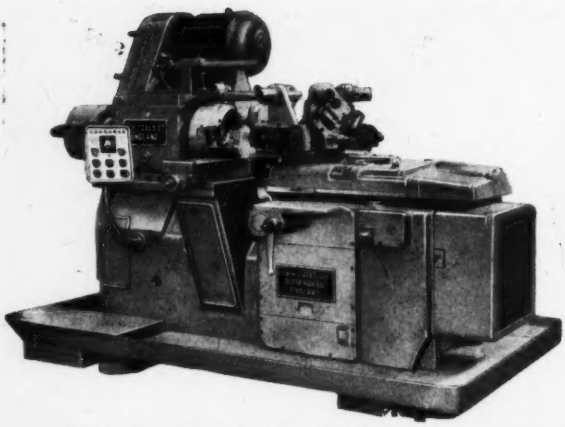
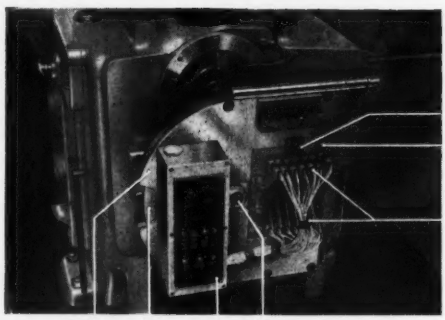


B.S.A. No. 95 all-electric chucking automatic with DISCOTROL programme control unit. The machining programme for a component is embossed on a metal disc. Quick change-over is effected by substituting the appropriate programme disc and the tooling. Resetting of machine speeds and feeds eliminated. Highly sensitive overload device protects tooling. Five face turret. Swing over cross slides 10¾in. (under bracket 12¼in.). Stroke: of cross slides 4in.; of turret 5¾ in. Thirty speeds 40 to 834 or 60 to 1,220 r.p.m.

the complete machine tools supply organisation



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Also distributors and stockists for prominent British manufacturers.

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B·S·A TOOLS DIVISION

sole agents U.K.

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BURTON GRIFFITHS & CO LTD
Kitts Green, Birmingham 33
Tel.: STECHFORD 4071. Cables: HIBOU BIRMINGHAM TELEX 33-207

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RAVENSBURG

Facing Copy Lathes

MODELS

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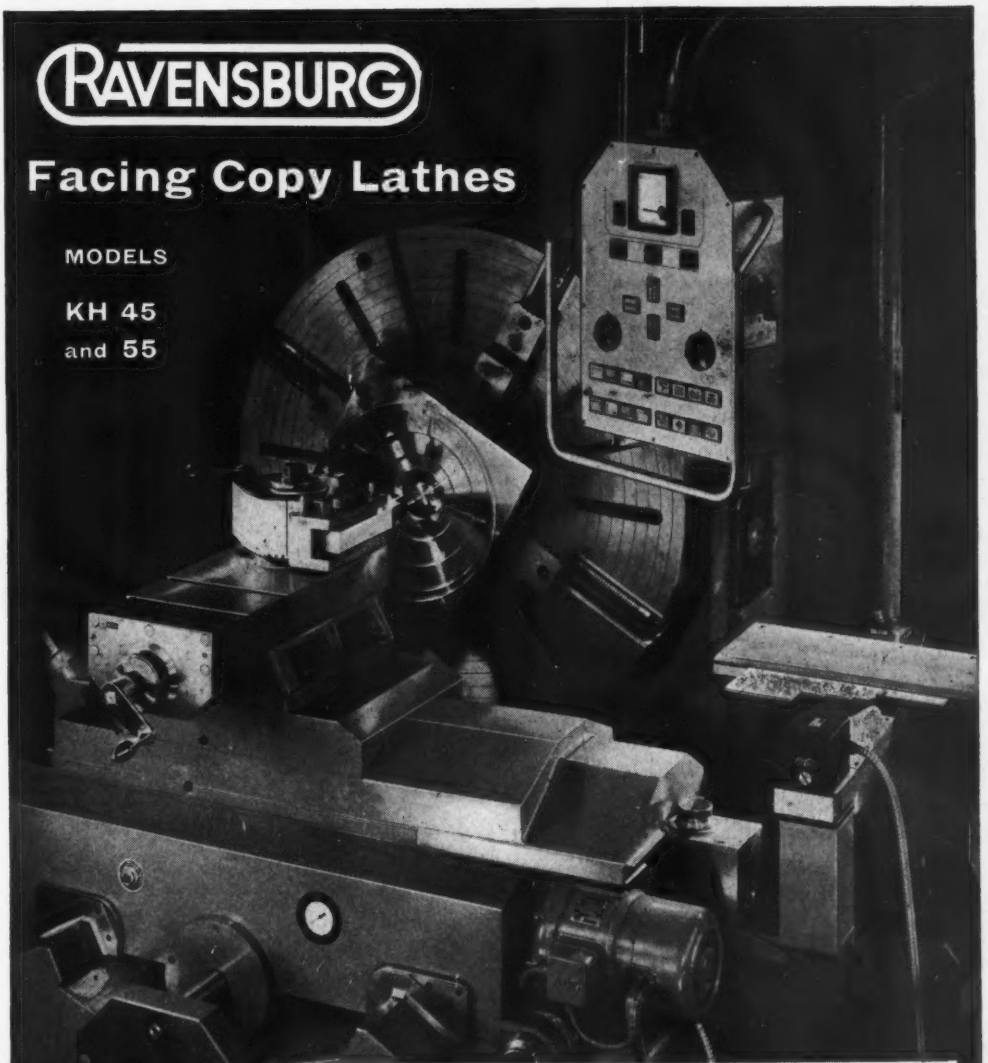
and 55

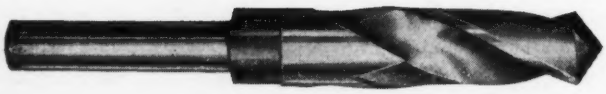


With the UNICOP electronic-hydraulic two co-ordinate copying system for machining deep and difficult profiles.
The headstock and carriage are mounted on a common bed with two vee-slides on which both can be traversed.
A single button on the pendant control panel sets the machine for use as a normal facing lathe without copying.
Available with infinitely variable spindle speeds and constant cutting speed control: Maximum turning diameter up to 55 inches.

SOLE BRITISH AGENTS

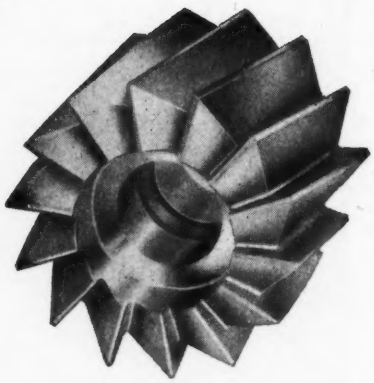
SYKES MACHINE TOOL COMPANY LIMITED

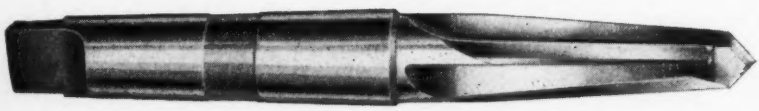
Hythe Works, The Hythe, Staines, Middlesex. *Telephone* Staines 55474 (5 lines) *Telegrams* Sytool Staines



For "standards" that are special

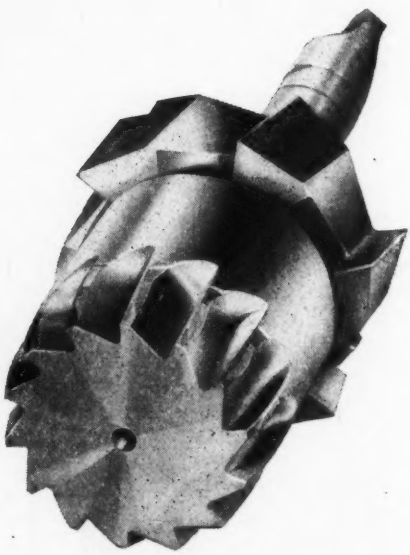
Jobbers drills · taper shank drills · reamers milling cutters · end mills side and face cutters angle cutters.





and "specials" that are extra special

"Lubricold" oil-hole drills · multi-diameter sub-land drills · taper reamer drills · armour piercing and manganese drills · combined parrellel drills and reamers · carbide tipped drills · engineers tools of all kinds to specification.



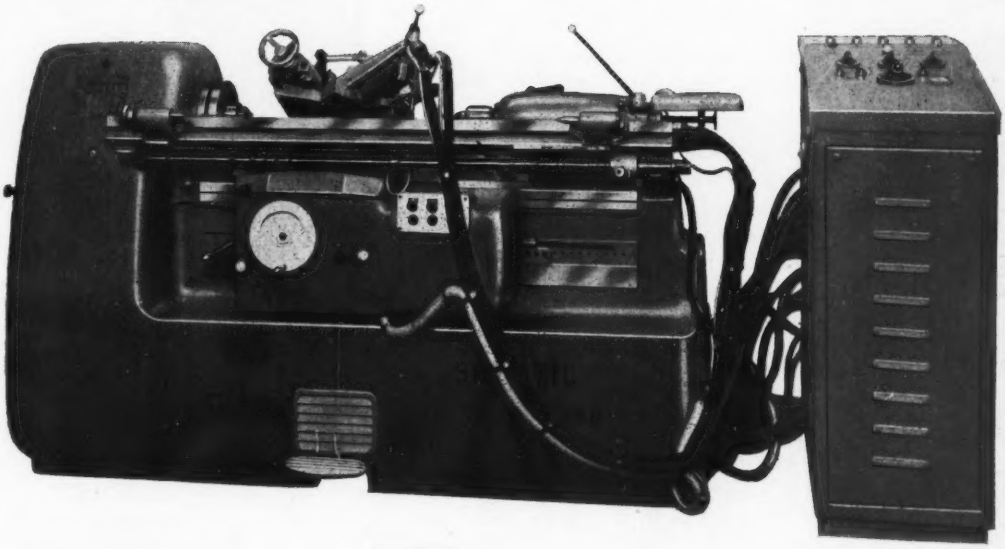
TALK TO

Stalker

Stalker Drill Works Ltd., Drill Square, Sheffield 6. Telephone: 343057

OA/5778

The NEW SICMATIC



Automatic and Semi-Automatic Hydraulic Profiling Lathes

Specification

Bore of spindle	2⅛in.
Spindle nose	5in. A.S.A.
Max. swing over bed	15¼in.
Max. swing over saddle ..	9¾in.
Max. length turned	27½in.
Hydraulic traverse of copying slide	4in.
Hydraulic feed of tailstock spindle	4¾in.
Number of feed rates to copying slide	48
Max. tool pressure ..	1,300 lbs.
Approx. net weight ..	5,000 lbs.

7 POINT FEATURES INCLUDE

1 Capacity.
2 Duplomatic Hydraulic Styems.
3 Hardened Bed Slideways.
4 Auto cycling up to six depths of cut.
5 Hydraulic tailstock for drilling and boring.
6 Uses template or existing component.
7 Eight models to choose from.

Basic price under £2,500.

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Daily demonstrations at our works

HERBERT WIDDOWSON & SONS LTD

Canal Street Works, Nottingham

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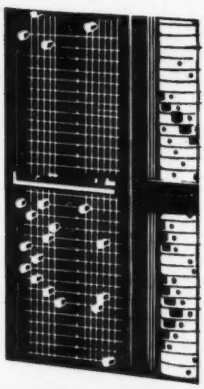
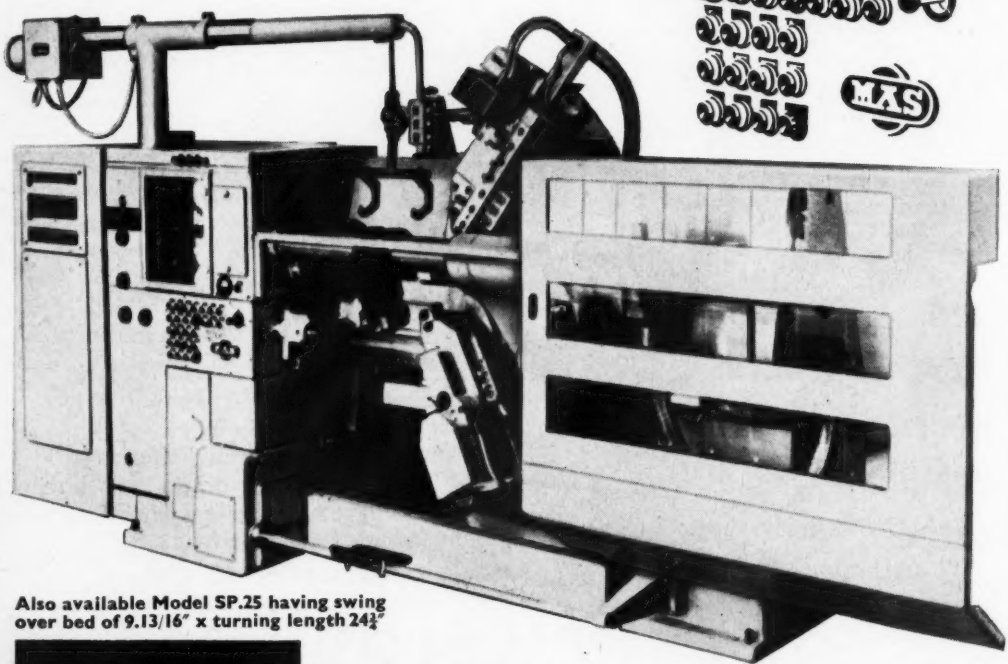
AUTOMATION TODAY'S NECESSITY



MAS Model SP·31 semi-automatic Copying Lathe with Programme Control

1. Electro-hydraulic control
2. Punch card selection of spindle feeds and speeds
3. Hydraulic tailstock, foot-operated
4. Two copying and one recessing slide
5. Short setting-up times enable economical production of small quantities

Max. turning diameter over bed	12¼"
Max. turning diameter over carriage	10"
Max. length	39½"



Also available Model SP.25 having swing over bed of 9.13/16" x turning length 24½"

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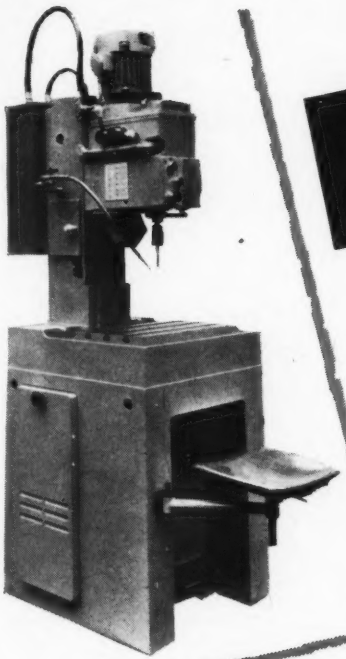

Joannès

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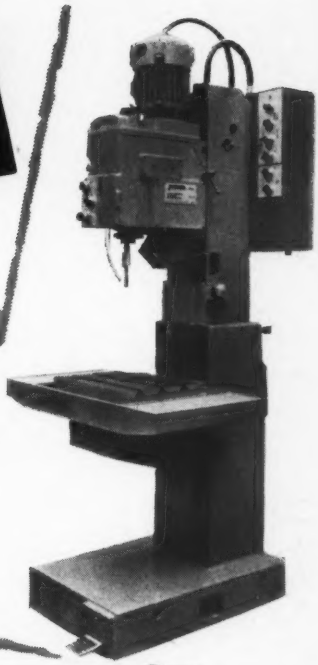
Automatic Hydraulic Controlled Pitch Tapping Machines

CAPACITY
$\frac{3}{16}$in. to $1\frac{1}{8}$in.



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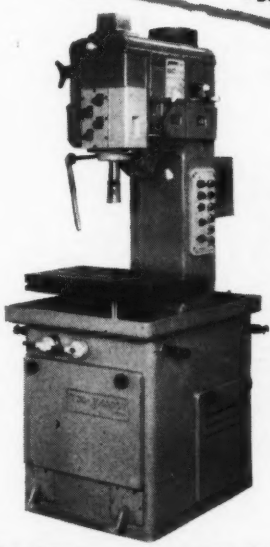
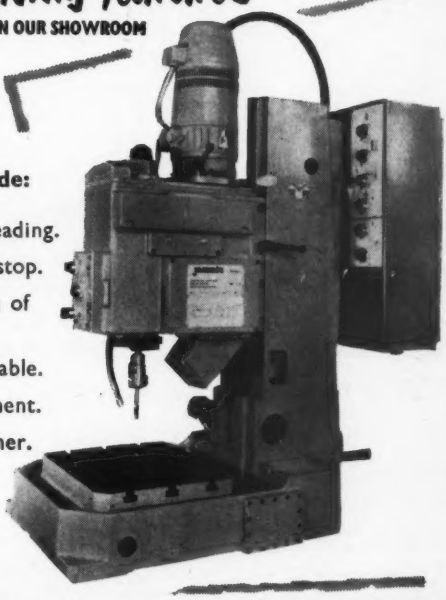
DEMONSTRATION MACHINE ALWAYS IN OUR SHOWROOM



Special Features include:

- Left or right hand threading.
- Hand or foot start and stop.
- Continuous lubrication of all moving parts.
- Hardened and ground table.
- Built-in coolant equipment.
- Removable chip container.



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We can give prompt delivery of portable electric tools ranging from soldering irons to valve grinding machines. The full range of **WOLF, BLACK & DECKER, BRIDGES,** and **KANGO** equipment is always in stock—so remember . . .

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D'ANDREA
Universal Boring, Facing & Turning Attachment
* NOW AVAILABLE WITH QUICK POWER RETURN TO TOOL SLIDE!
3 sizes 8, 12 & 16in. diameter facing capacity
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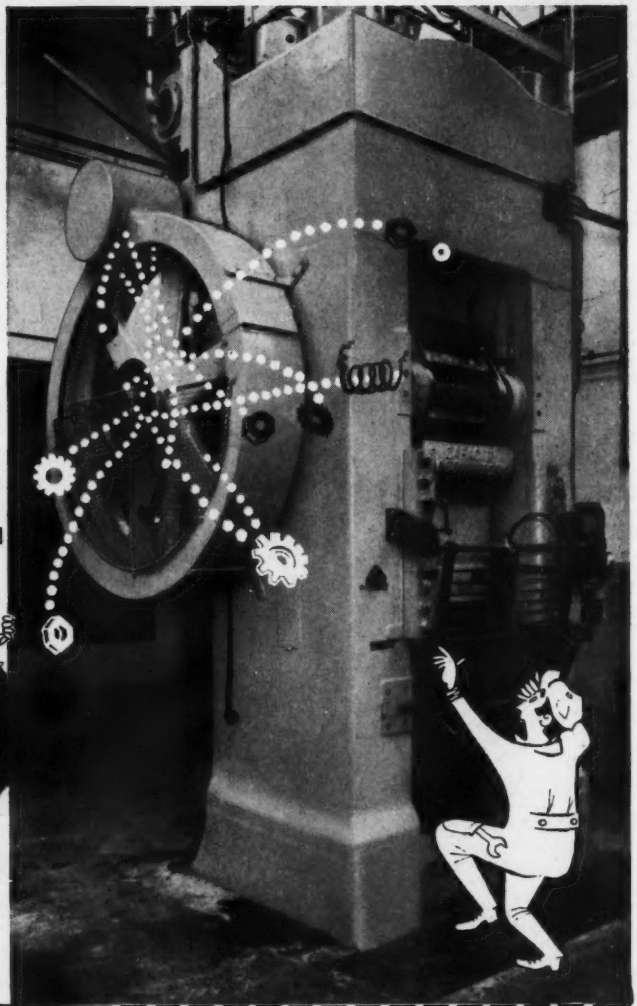
When Joe's got his hands on a crafty 'cuppa' the last thought in his head is lubrication schedules. It's not that he means to cause a production hold-up, it's just that you can't trust a bloke like Joe the way you can Tecalemit Mechanical Lubrication Systems. They're sticklers for duty! Minute by minute *metered* shots of lubricant are fed to each and every bearing. Machines run more smoothly, have longer working life, give more reliable service. There are systems in the Tecalemit range to fit all machines and plant—new or existing—and to handle all lubricants—oil or grease. Get them to work for you—they never stop for tea!

JOE PROVES THAT TEA AND OIL DON'T MIX



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TECALEMIT (ENGINEERING) LIMITED

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Please send me full information on:

SINGLE-LINE *Grease Injection System*—feeds each bearing through an independently regulated injector. ☐

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BRENTFORD *Automatic Multiline Oiling System*—has one to twenty-four lines, each with an independently regulated pump. ☐

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AUTOMATIC TRANSFER UNITS

Electro-Hydraulic single or multiple units for
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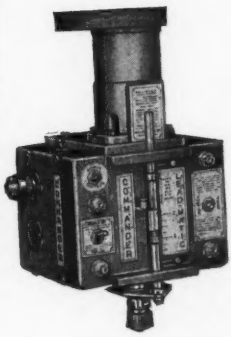
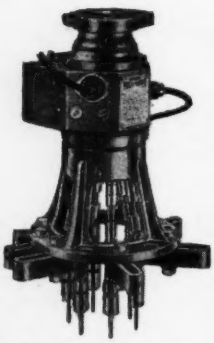
Spring clutch drive, adjustable torque control, eliminates tap breakage.
Range: 10 BA to ¾in.—16 t.p.i.

PNEU-MATIC TAPPER
High speed production tapper, fully automatic; torque control to prevent tap breakage. Pitch control by lead screw optional.
Range: 10 BA to ¾in.—16 t.p.i.

LEAD-MATIC TAPPER
Automatic precision tapper with easily interchangeable lead screw. Electric control by hand, foot or fixture operated switch. Fits any drilling machine.
Range: 10 BA to ¾in.—16 t.p.i.

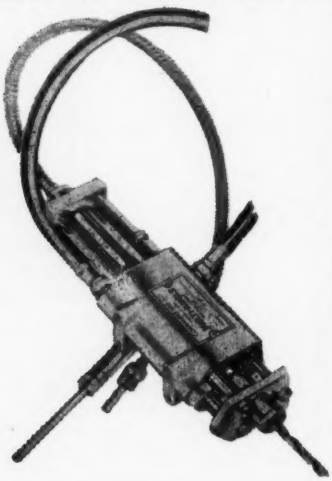


COMMANDER FOR DRILLING & TAPPING



MULTI-TAPPER
Taps up to 8 by ¼in. threads at one stroke; universally adjustable from ¼in. centre to 9in. P.C.D. (22½in. P.C.D. with extension spindles) Taps different pitches simultaneously. Accurate depth control. Fits any drilling machine.
Also available as MULTI-DRILL.

MULTI-ANGLE DRILL UNITS
Low-priced compact units for special set-ups for drilling at odd angles, re-set rapidly for another job. Flexible shaft drive, self-contained hydraulic feed system. ⅜in. dia. capacity, 4in. stroke.



SELECT-A-SPINDLE
Allows three operations on any one drill spindle. Single or two-speed and self-reversing tapper model available.
Drills ⅜in., taps $\frac{5}{16}$in. in steel.

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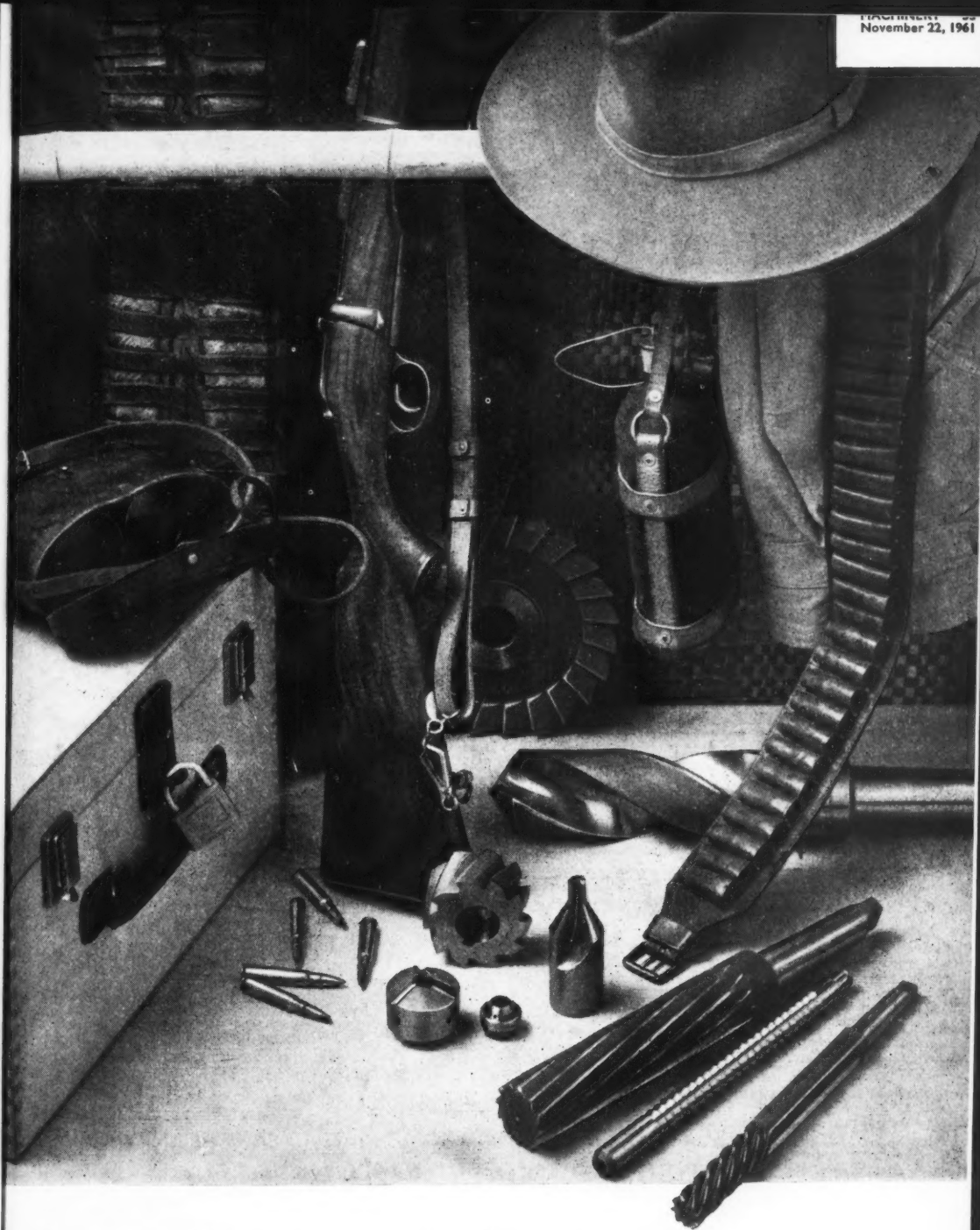

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of resourceful engineers—**QUALCUT TOOLS**

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WHATEVER THE DUTY
— if it's verticals

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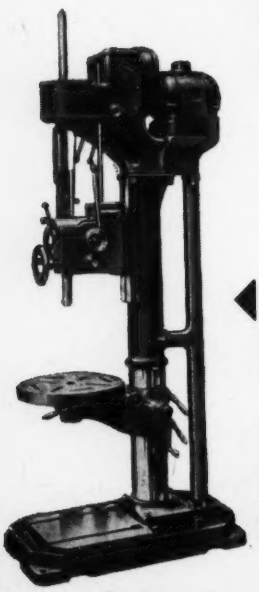


MODEL 28 AN
HEAVY DUTY GENERAL PURPOSE DRILL

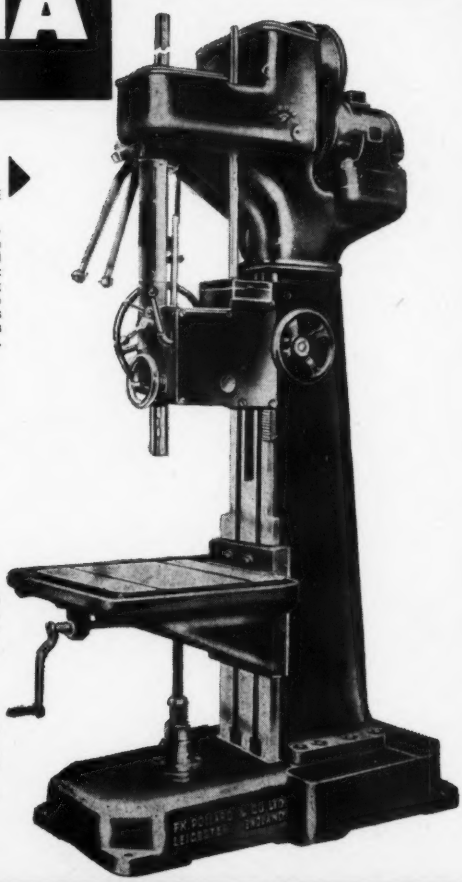
With a drilling capacity of up to 2in. in M.S., these machines have nine spindle speeds up to 489 r.p.m. and six automatic feeds, with electric reverse if required. Ball bearing mounted gear drive. Available in gang drills with two to six columns on one base. Two other models available, with capacities of 1¼in. and 1½in. respectively.

MODEL 21 AR
ROUND COLUMN MACHINE

Available in three sizes with capacities of 1¼in., 1½in. and 2in. respectively. Similar in performance and characteristics to the box column machine.

*

THERE ARE 'CORONA' DRILLING MACHINES FOR EVERY DUTY FROM SUPER HIGH SPEED SENSITIVE TO HEAVY DUTY SINGLE SPINDLE AND MULTI-DRILLS. CONSULT US ON YOUR OWN DRILLING PROBLEMS.



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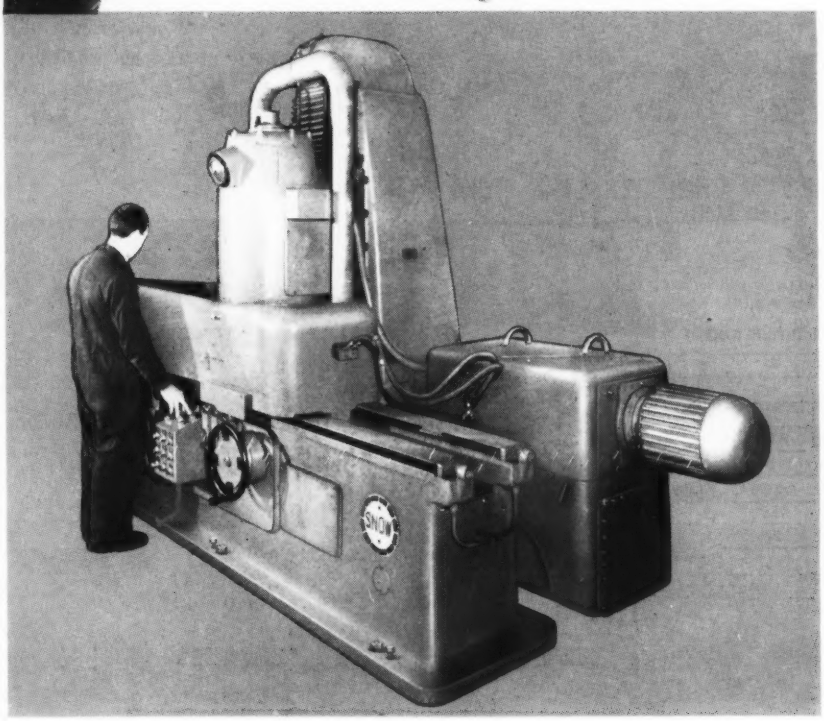
1961

SNOW SURFACE GRINDING MACHINES

for continuous and accurate production

These vertical surface grinders are robustly constructed for the high-output production of flat surfaces on almost all types of material. They can be relied upon for maximum production with minimum down time for servicing and maintenance—requirements of particular importance in the motor industry.

Available in a range of sizes with segmental grinding wheels up to 24 in. diameter and power of main drive motor up to 60 h.p.



This Type V18 Snow Vertical Surface Grinding Machine installed at Fisher and Ludlow Ltd., Birmingham, is grinding the centre faces of rear axle casings.

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DRUMMOND-ASQUITH LIMITED

Member of the Asquith Machine Tool Corporation

KING EDWARD HOUSE. NEW ST . BIRMINGHAM *Phone: Midland 3431* *Also at LONDON Phone: Trafalgar 7224 & GLASGOW Phone: Central 0922*

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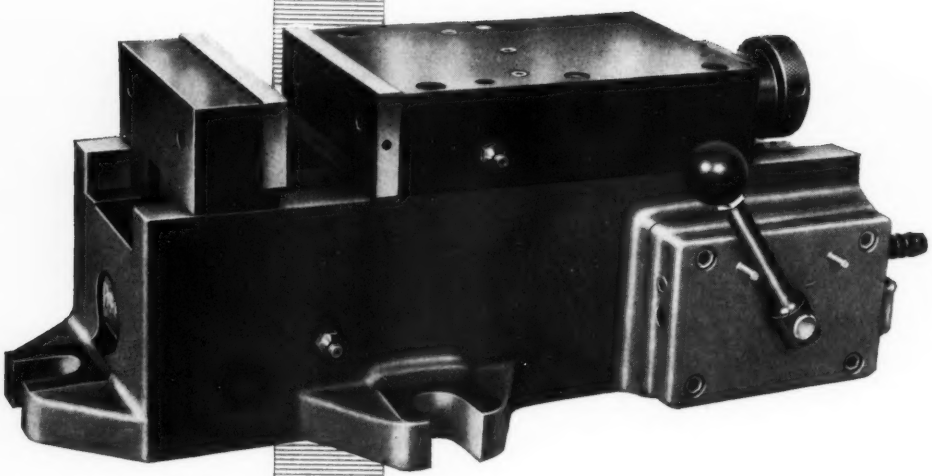

The PRATT

PNEUMATIC MACHINE VICE

PRINCIPAL DIMENSIONS

Width of Jaw	4⅛″	6″
Depth of Jaw	1⅝″	1⅞″
Maximum Opening	2½″	4¼″
Minimum Opening	0″	1¾″
Power Movement	⅛″	⅛″
Gripping Force at 80 P.S.I.	4,800 lbs	7,700 lbs
Length Overall	15½″	19¼″
Width Overall	7½″	9½″
Height Overall	5¼″	6⅛″
Weight (approx.)	54 lbs	126 lbs

RAPID OPERATION

HIGH GRIPPING POWER

NO OPERATOR FATIGUE

ROBUST CONSTRUCTION

AMPLE BEARING SURFACES

FOR INCREASED PRODUCTION

F. PRATT & CO. LTD. HALIFAX ENGLAND

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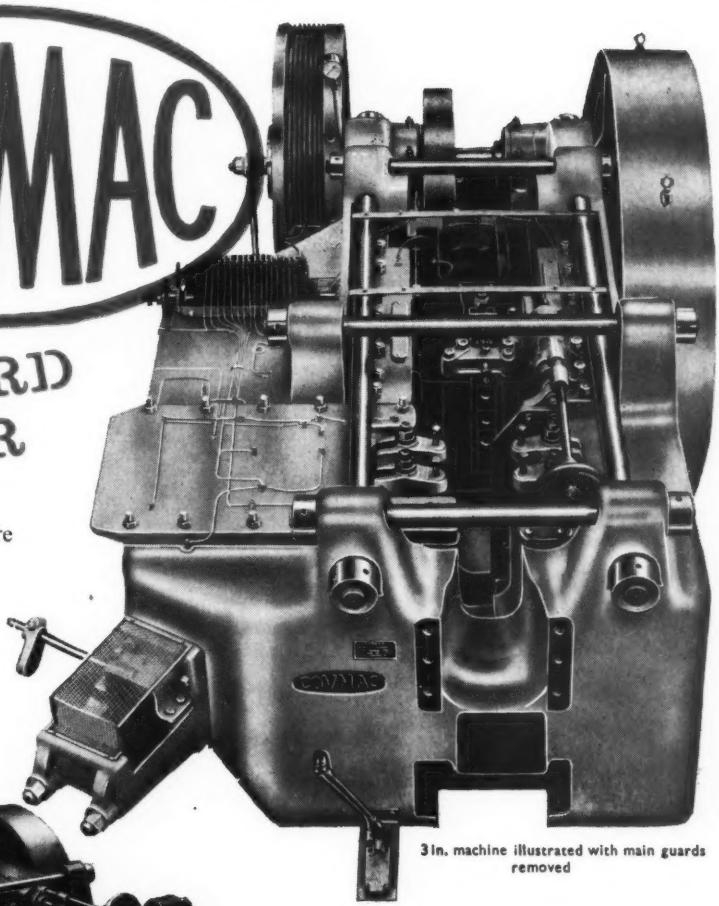
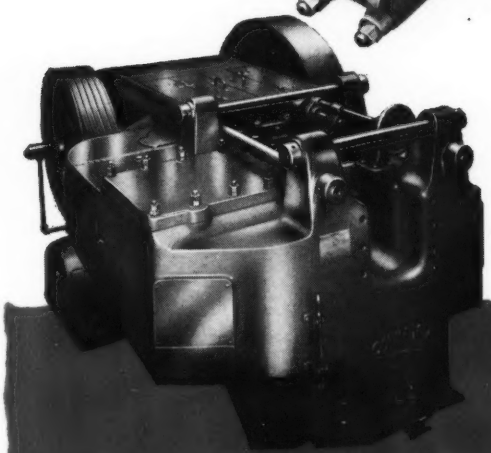
COVMAC

STANDARD FORGER

Covmac Forging Machines are made in nine sizes to take bars from ¾in. to 6in. diameter. Safety devices on all models prevent overloading.



3in. machine illustrated with main guards removed



Covmac also make Automatic Forging Machines, as well as machines for making balls up to and including 4in. diameter. In addition there are three sizes of Hot Milling and Sawing Machines.

COVENTRY MACHINE TOOL WORKS LTD
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take great pleasure in announcing the conclusion of an agreement which, among other things, provides them with

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including **Gear Shaving**
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NEW MODEL "S" SUPER CHUCK

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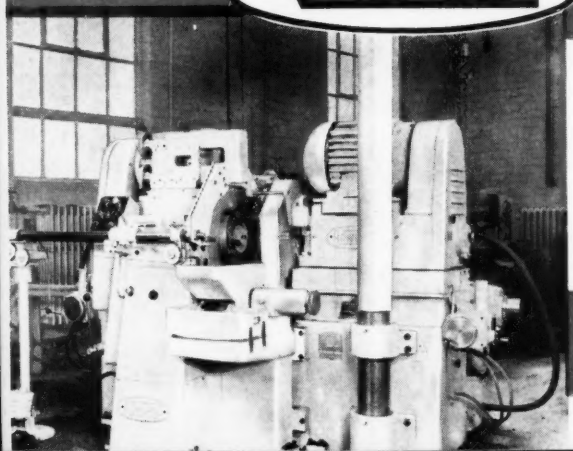
finest..fastest production machines of their type

DUPLEX ROWLAND SURFACE GRINDERS



FINISHES BOTH SIDES SIMULTANEOUSLY

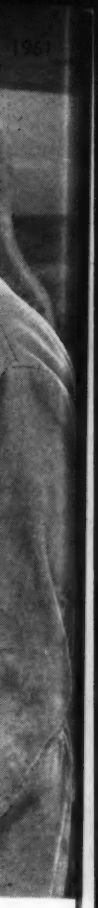
. . . . CUTS COSTS IN HALF

This machine, recently installed in the works of Spirax-Sarco Ltd., is seen simultaneously grinding both faces of small circular components to exceptionally fine limits at extremely high rates of production.

F.E.ROWLAND & CO.LTD.

PHONE: HEATON MOOR 3201/2/3
GRAMS: HEROIC REDDISH

CLIMAX WORKS, REDDISH, Near STOCKPORT



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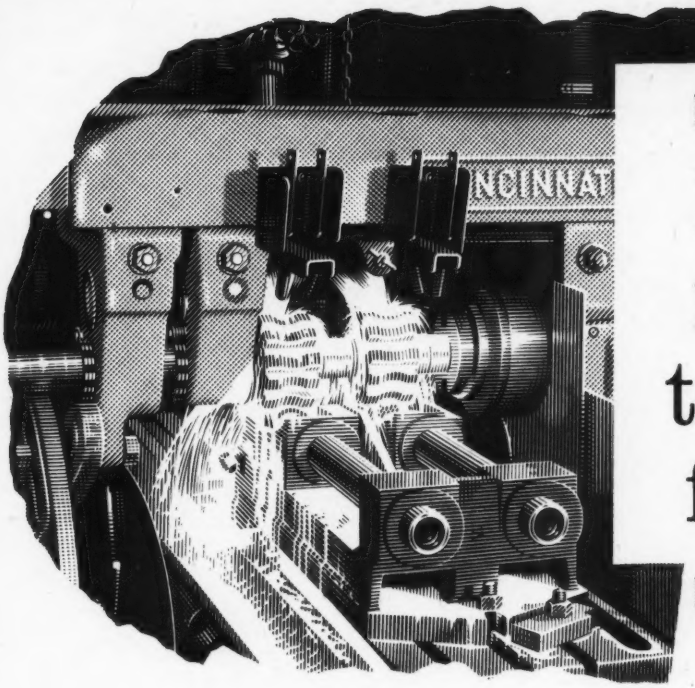

It's a fight to that finish

These are highly competitive days, when all production effort is geared to one objective—to make an article just that bit quicker, better or cheaper than the next fellow. This worthy motivation leads to profits—production and financial. Something about mousetraps comes to mind but we'll spare you the repetition. Aren't we all machinists anyway? Sometimes, of course, the finish is a fight in itself. Newer materials, unfamiliarity with techniques used elsewhere, switching over to new contracts, turnover of labour —all these factors pose fresh problems to those men in your organisation who are paid to have production headaches—and solve them. Speaking for ourselves, co-operation is far from being a hollow sentiment at the foot of a letter. Maybe we can help. If you are waging a private joust with poor finish (and losing), leading a personal crusade to improve tool life or just grumbling for the hell of it, maybe we could come in on your particular problem. If cutting fluids can assist in any way, we have a nice string of thoroughbred products, all raring to go and machine trained to boot. After 45 years, we should know our onions — and our production oils. Interested? Then call in the experts.

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FLETCHER MILLER *cutting fluids*

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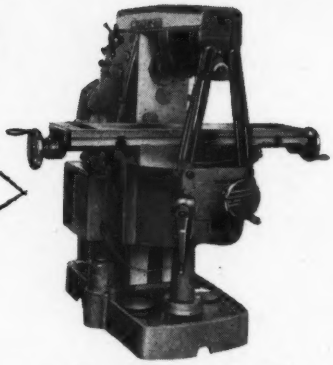
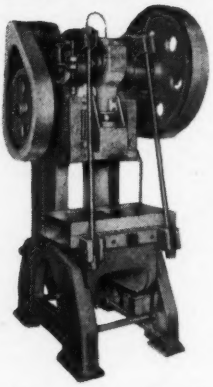
Telephone: HYDE 3471 (5 lines) Telegrams: EMULSION, HYDE

CF 130

Dimco B.C. 2000 Universal Milling Machine
Table size 48in. by 11in. Swivels 45°
Power feed in all directions
Spindle Speeds 30 – 1320 r.p.m.
Spindle No. 40 ISA
PRICE £1350 0 0
Extra Equipment Vertical attachment £100 0 0
8in. plain dividing heads £74 0 0



Dimco manufacture and distribute



Dimco 60 ton open fronted inclinable Power press adjustable stroke – geared
Table surface 29½in. by 18½in.
Strokes per minute 70
Nett weight 6,175 lbs.
Dimensions 44ins. by 62ins. by 97in.
PRICE £995 0 0
Standard Equipment:—Bolster plate, pressure on shot lubrication, belt guards, foot operated electric switch. Two button hand switch. Motor and electrics 400/440/3/50.

British and Continental machine tools

Dimco CM 60 Universal Milling Machine
Table size 42in. by 9½in. Swivels 45°
Power feed and Rapid Traverses in all directions.
Spindle speeds 50 – 890 r.p.m.
Spindle No. 40 ISA
PRICE £955 0 0
Extra Equipment Universal
Vertical attachment £45 0 0
Universal dividing head £65 0 0

DIMCO (GT. BRITAIN) LTD.

For further information, please contact:—
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with

Par-a-Matics

Engineers, faced with the problem of urgent delivery schedules, make full use of the versatility and adaptability of "ARO-BROOMWADE" Self-feed Par-a-Matics. These high speed pneumatic units can be set up to drill, counterbore, tap, ream, grind, deburr, or drive screws in straightforward sequence or in complicated cycles.

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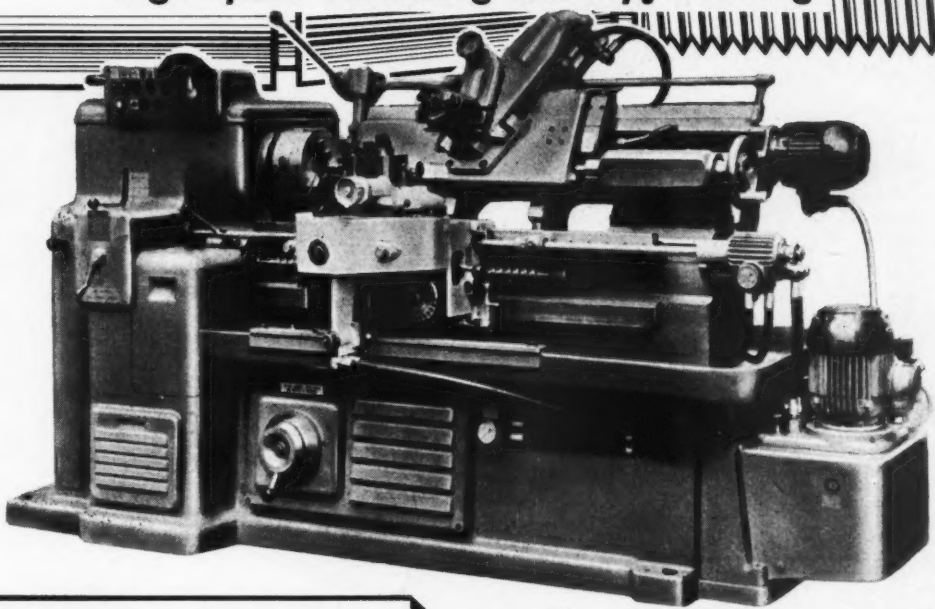

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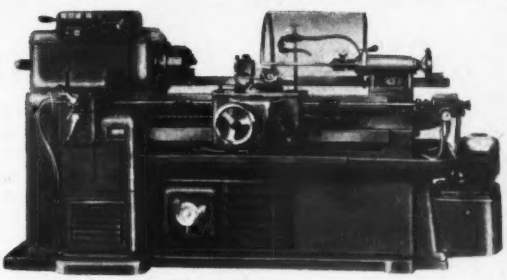

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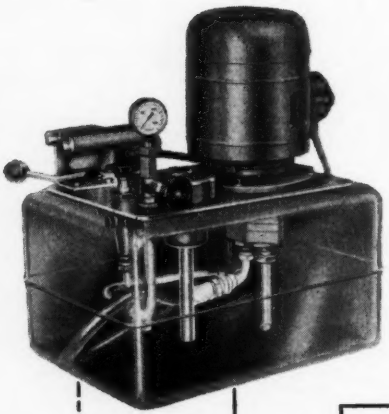

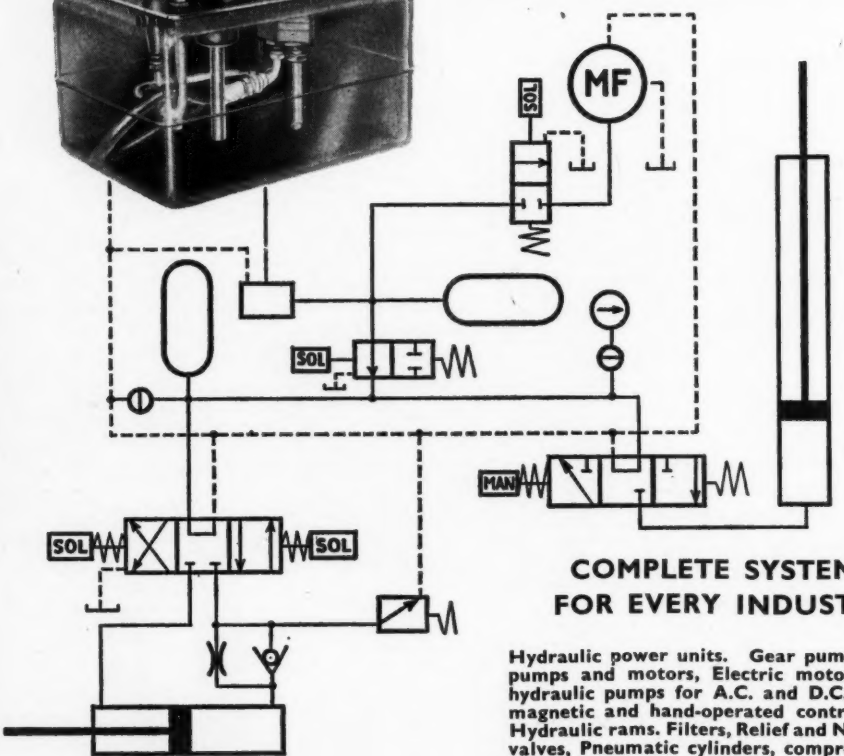

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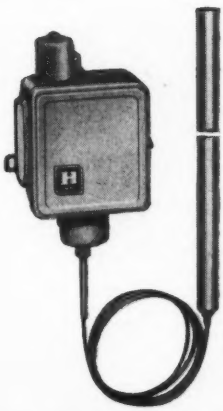

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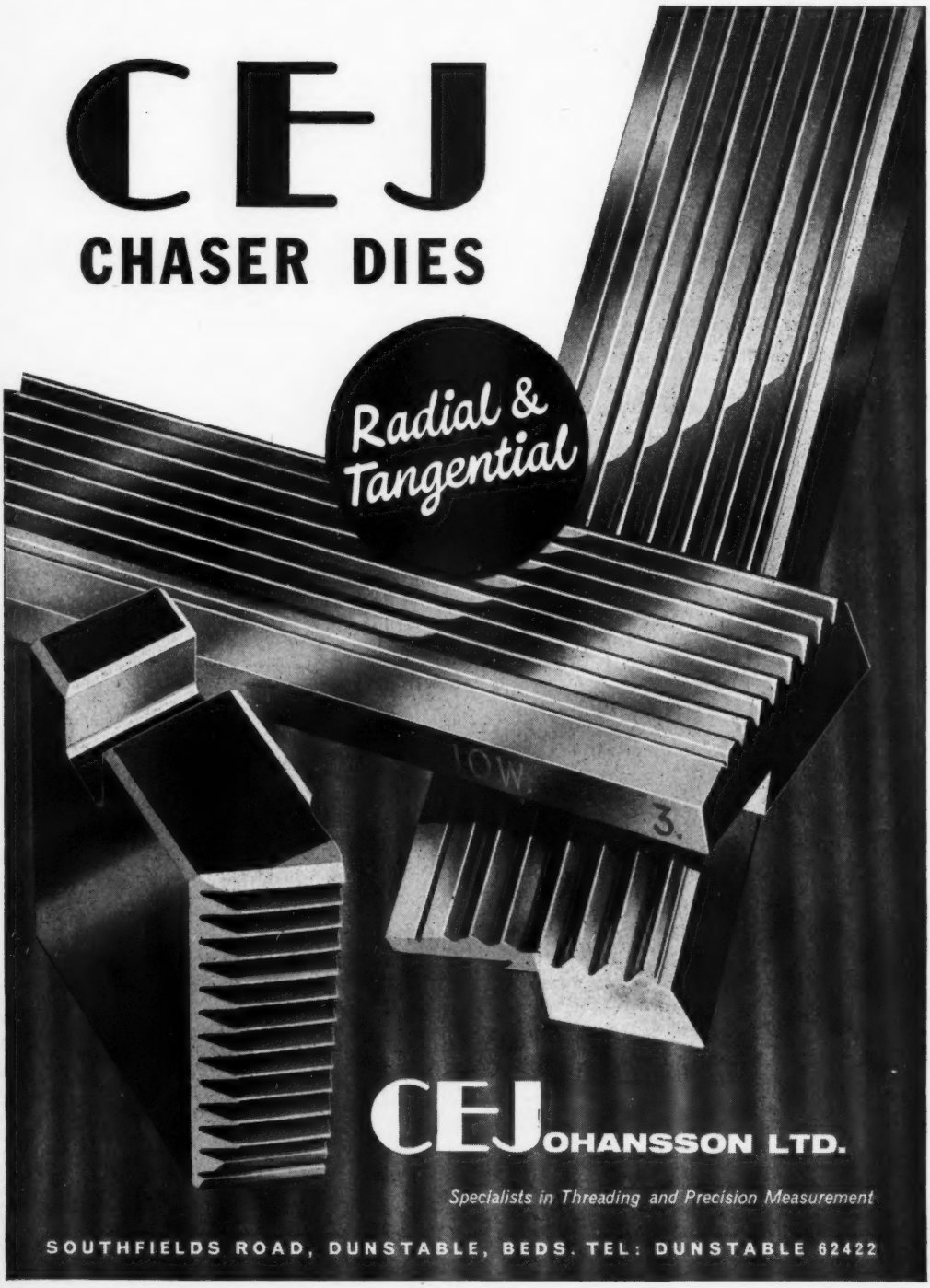

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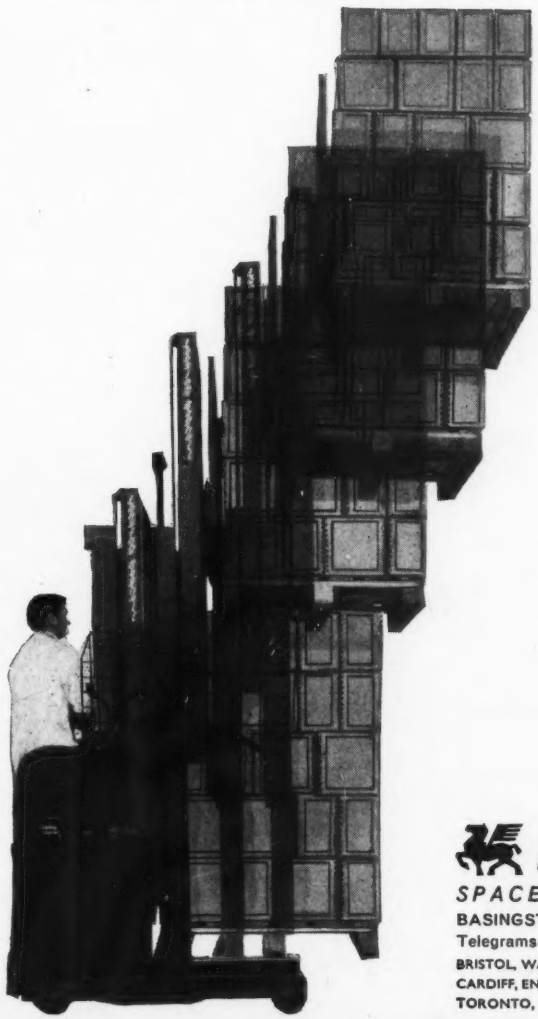

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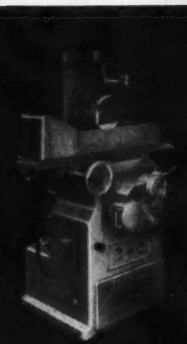

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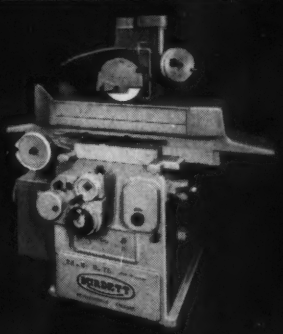

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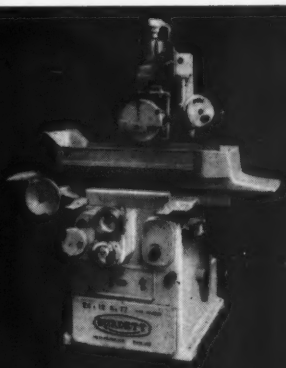

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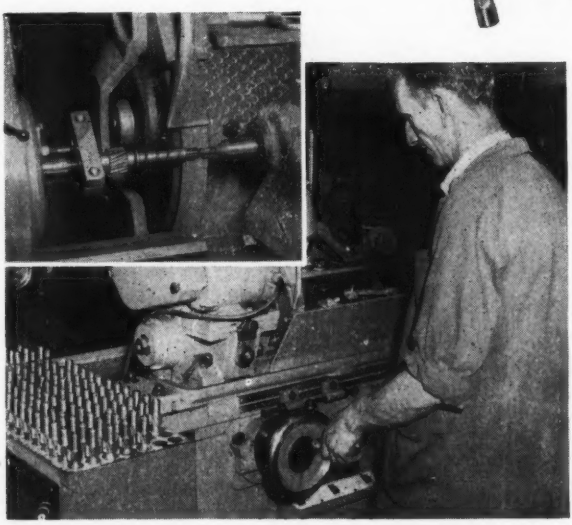

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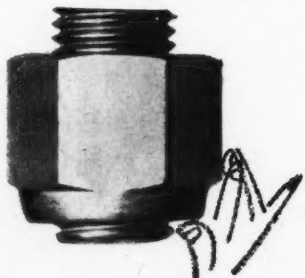

** These times are based on 'The Handbook of Standard Time Data for Machine Shops' by Haddon & Genger published by Thames and Hudson Limited, London.*

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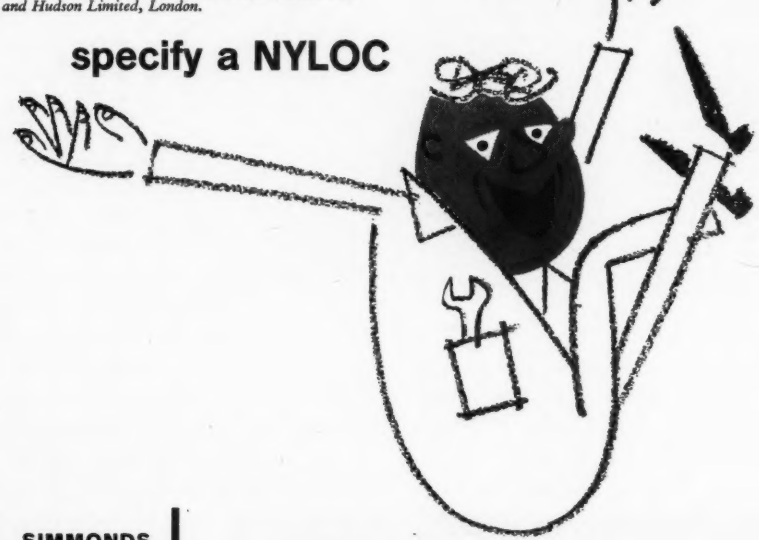

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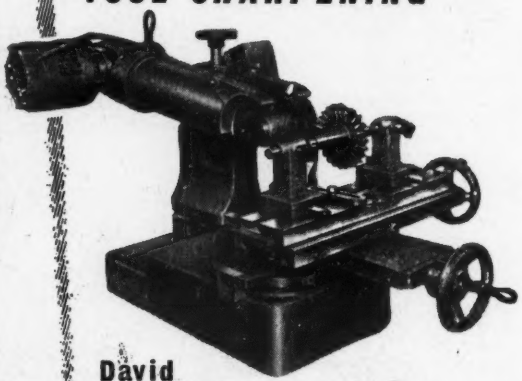

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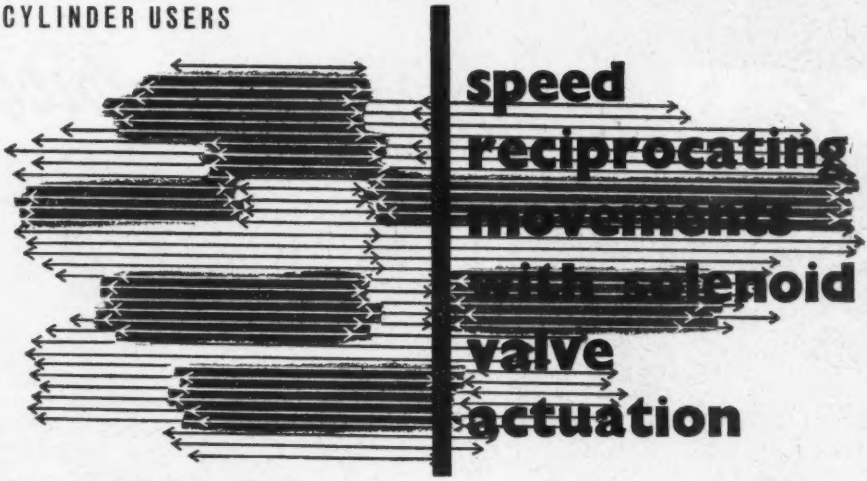

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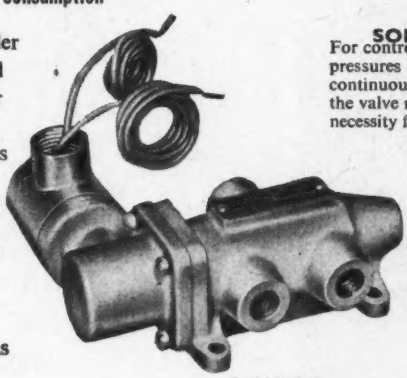

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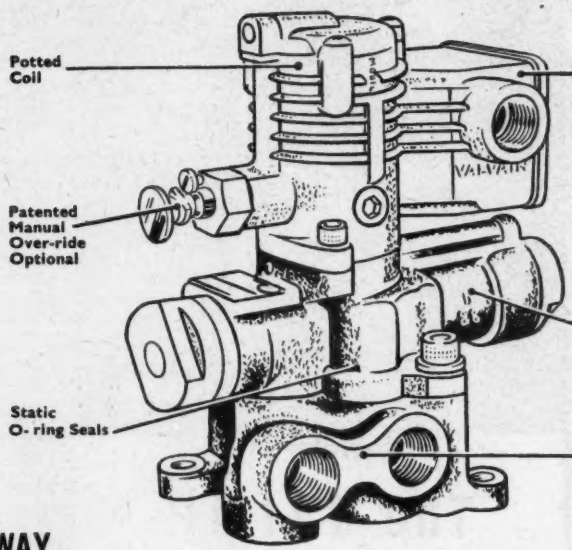

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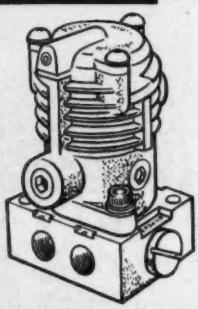

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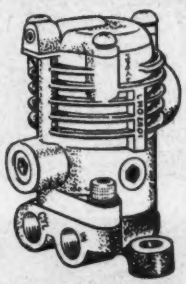

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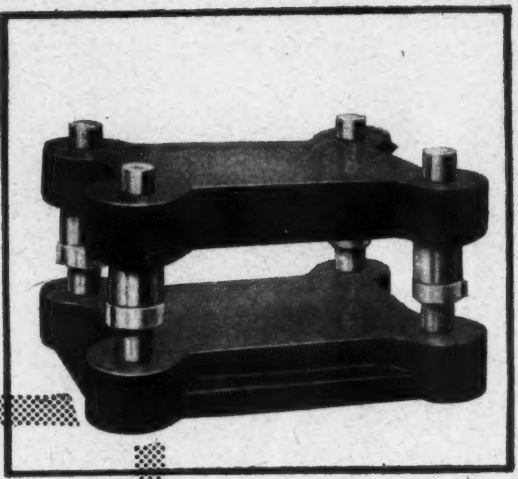

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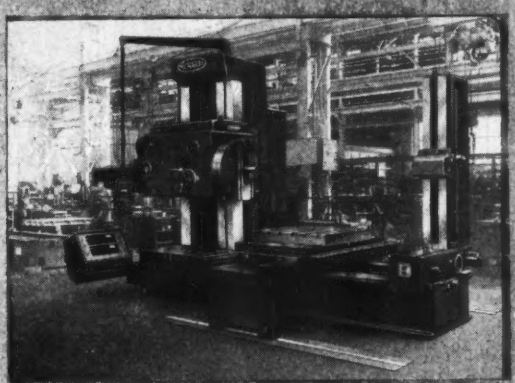

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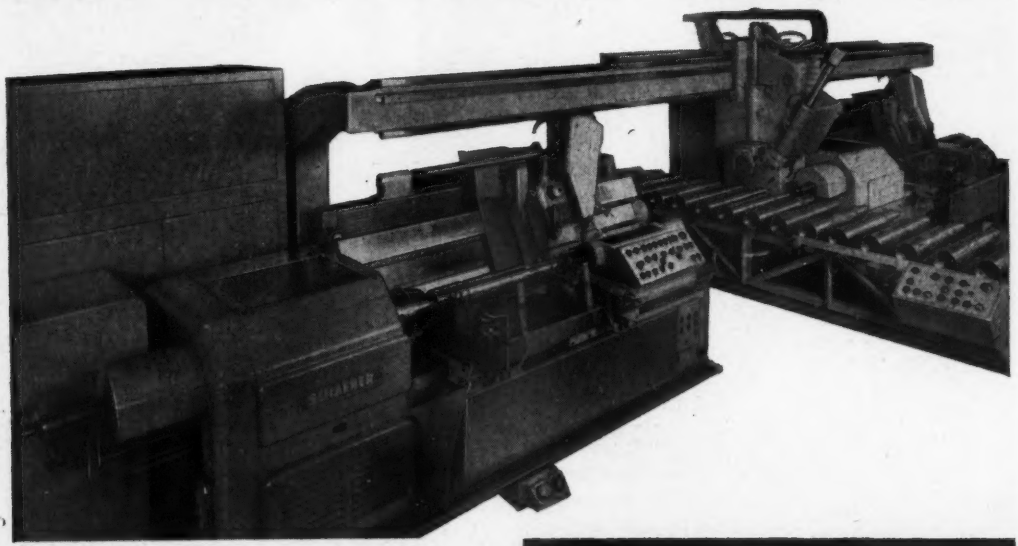

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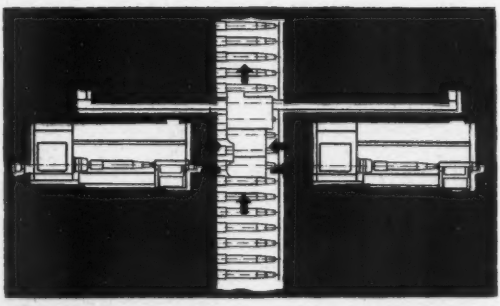

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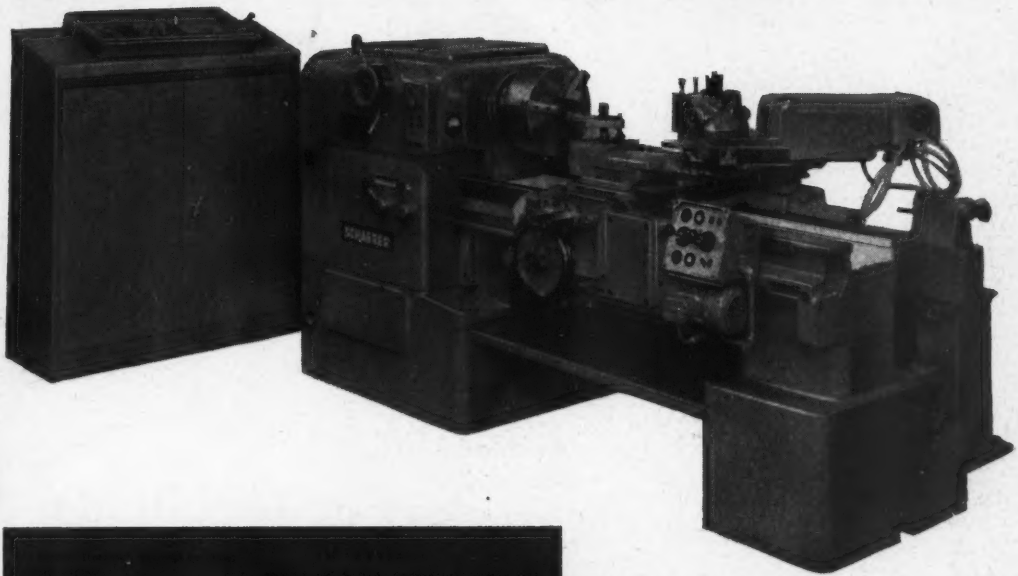

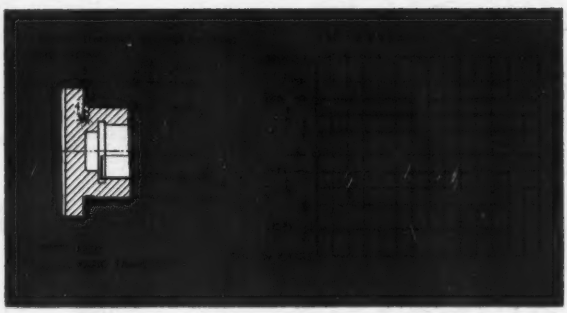

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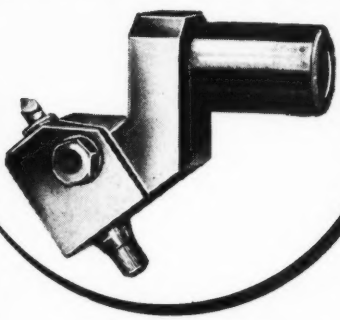

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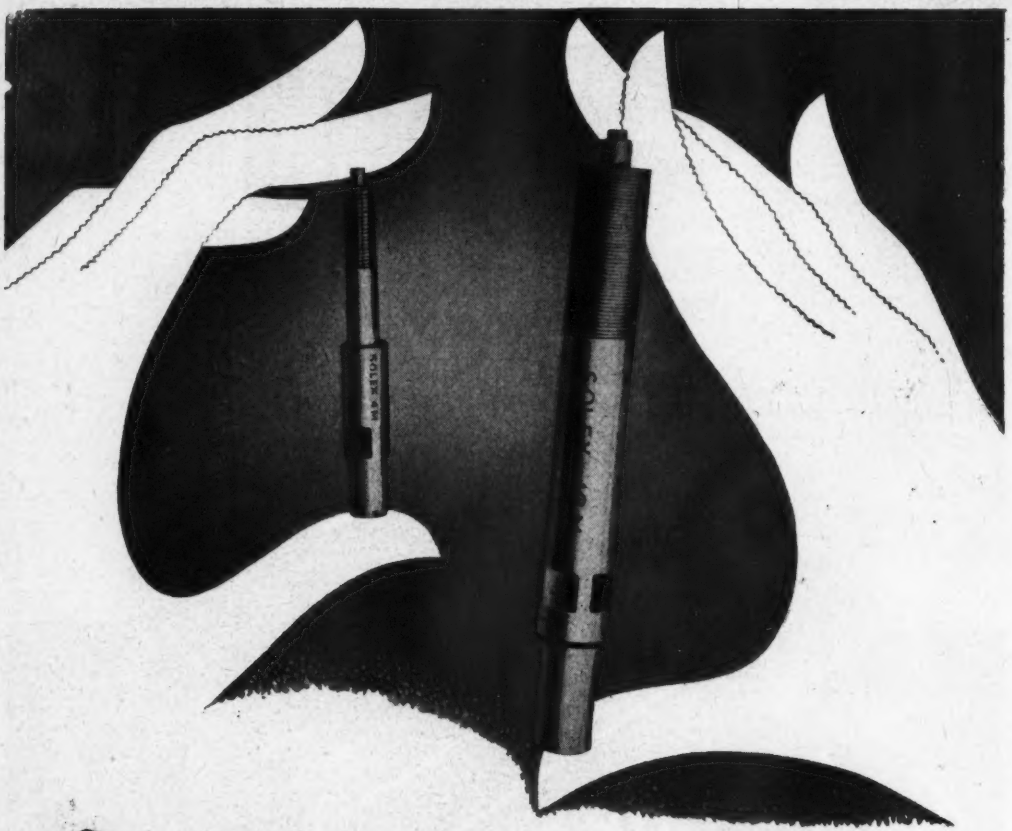

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Abstracts of Principal Articles

Producing the C.A.V. Type DPA Diesel Fuel Distributor Pump .. .. P. 1180

The second of a series, this article deals with the production procedures for the rotor, sleeve and barrel. Various drilling, tapping and reaming operations are carried out on these parts with the aid of German-built Otnima machines, which incorporate swivel-mounted unit heads arranged around a rotary indexing table. A fully-automatic Ex-Cell-O twin-spindle machine is installed for fine-boring sleeves, and the latter are automatically loaded and unloaded, also gauged. Other equipment described includes special multi-head Mollart machines for drilling ports in rotors and sleeves, Taylor Hobson optical inspection equipment, and a Delapena automatic induction heating and assembly machine, whereby sleeves are inserted in barrels. (MACHINERY, 99—22/11/61.)

Design of Negative Rake High-speed Steel Tools for Planing.. .. .. P. 1189

The advantages to be gained from negative rake planing tools are discussed in some detail in this article, including the increased strength which is conferred in the region of the cutting edge, and improves resistance of the tool to the impact as it enters the work. The various tool forms to provide for maximum feed and maximum cutting speed are considered, also the advantages to be gained from fairly large approach angles. With the types of tools here discussed, which are admitted to be unorthodox in appearance, it is claimed that improved surface finish and tool life have been obtained. (MACHINERY, 99—22/11/61.)

William Asquith, Ltd., Highroad Well Works, Halifax .. .. .. P. 1195

This article in the series on machine tool building in Britain is concerned with the works of William Asquith, Ltd., Highroad Well, Halifax. Founded in 1865, the works are the largest manufacturing subsidiary of the Asquith Machine Tool Corporation, and are claimed to be the largest in the world devoted to the building of drilling and boring machines. The site extends to 12 acres, and the buildings now cover more than 200,000 sq. ft. A large assembly bay for the erection of heavy machine tools has recently been built, and a large pit in this bay provides 50 ft. clearance under the hooks of overhead cranes. There are about 1,000 employees, and the accompanying illustrations show some typical set-ups and items of equipment in the machining and assembly shops. (MACHINERY, 99—22/11/61.)

Delapena Automatic Machine for Honing Cylinder Barrels .. .. .. P. 1204

Supplied to an Italian tractor-building company, the machine here described was designed and built by Delapena & Sons, Ltd., and provides for honing the bores of cylinder barrels for air- and liquid-cooled diesel engines. It has twin working heads, which provide for rough and finish honing operations, and automatic gauging equipment supplied by Teddington Industrial Equipment, Ltd., is incorporated. (MACHINERY, 99—22/11/61.)

Scully-Jones Tool-holders .. .. P. 1208

B. O. Morris, Ltd., Coventry, have recently been appointed sole licensees in the United Kingdom and E.F.T.A. countries for the tool-holders, including the quick-change type, developed by Scully-Jones & Co., Chicago, U.S.A. The various types of holders are described in some detail, including the Safe-Torque tap-holder, which allows a predetermined torque to be set and incorporates a free-wheeling arrangement. (MACHINERY, 99—22/11/61.)

Continuous Path Machine Tool Control P. 1211

Abstracted from a paper delivered at the Second International Machine Tool Design and Research Conference, this article describes a continuous machine tool control system which is based on the use of coarse gratings, that is gratings with lines spaced at less than 500 to the inch. Shuttering, rather than diffraction, effects are produced when an index grating is passed over the measuring grating which is provided with lines at the same pitch. Four photo-electric cells are employed, in conjunction with an optical system which reflects light from the measuring grating, and it is stated that the system can interpolate to an accuracy of $\pm$ 0·0002 in. (MACHINERY, 99—22/11/61.)

IN FORTHCOMING ISSUES

Making the new Borg Warner automatic transmission—Special machine for sorting screws—The 7th European Machine Tool Exhibition—Richards type 38 horizontal boring machine with tape control.

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EDITORIAL

Refinements in Rotary Motions

With the object of ensuring improved performance of machine tools and many other types of mechanical equipment, increased attention has been directed in recent years to problems associated with rotating members, and there have been some very important developments in this field. In the first place it is becoming increasingly necessary to provide, in many instances, for an extremely high degree of axial stability when a part is turned either continuously, during operation of the machine or mechanism, or intermittently for indexing purposes. There have been numerous advances in bearing design for the purpose of achieving greater constancy in the position of the axis of rotation under varying conditions of operation, some of which are yielding excellent results. Certain of these bearing arrangements depend primarily upon extreme precision of component parts, whereas in others reliance is placed upon the self-centring effects obtainable with films of fluid or gas.

As an indication of the degree of accuracy that is now attainable by utilizing special production equipment and techniques, reference may be made to so-called "20-millionths" ball bearings which are being produced primarily for the inertial guidance systems of ballistic missiles. It is stated, for example, that the outer race for one of these bearings is held to limits of +0 −40 micro-inches for outside diameter and that a tolerance of 20 micro-inches is maintained for outside diameter and raceway roundness, radial run-out, outside diameter taper, side run-out with outside diameter, parallelism of sides, and parallelism of raceway with side. In general it is claimed that a ten-fold improvement in accuracy has been achieved, in comparison with ABEC-7 tolerances, but at a hundredfold increase in cost.

Mention was made above of gas lubricated journal bearings and in this connection attention may be drawn of the very valuable work that is being done by the National Engineering Laboratory on air bearings of both externally pressurized and self-acting types. One of the advantages of the pressurized air bearing is that high precision of the axis of rotation can be obtained even at low speeds without the necessity for extreme accuracy, and consequent high expense, in the production of the bearing surfaces. Self-centring bearing arrangements for which oil is supplied under pressure have also been used successfully for some years, and increased attention is now being paid to the possibilities of hydrostatic thrust bearings where heavy loads must be supported. These bearings may offer particular benefits where smooth motion at very low speeds is necessary. Yet another method of ensuring an accurate self-centring action in a bearing is by the application of magnetic force.

Given a stable axis of rotation, the accuracy of division that can be achieved with a rotary table will normally depend upon the precision of the graduations and the refinements of the reading system, or upon the means of positive location provided. With more recent developments, however, it is claimed that great improvements are possible as compared with the results obtainable with more conventional arrangements. Attention may be drawn, for instance, to the dynamic method of measuring angles by means of a circular magnetic scale which has previously been described in MACHINERY. With this system, it may be recalled, exceptional results are said to be obtainable despite any inaccuracies that may be present in the recorded pattern. It may also be noted that work is now proceeding at the National Engineering Laboratory in connection with the development of radial diffraction grating systems which may permit division to a very high degree of accuracy.

In particular, however, it is improvements in the relative uniformity of rotary motions, or of rotary and linear motions, that are being sought at the present time. Two methods whereby departures from uniformity can be detected with remarkable sensitivity have already received considerable publicity, and it will suffice to mention here that one depends on circular magnetic scales, and the other, on radial diffraction gratings. With a third system, which is also said to be proving very effective, fluctuations of motion are determined by an instrument known as an angular dynamic displacement tester. This highly sensitive accelerometer incorporates an inertial mass which is suspended on frictionless cross-spring pivots in a housing and is arranged for magnetic damping. When the housing is mounted on a shaft or table, and the latter is driven, the axis of suspension of the mass coincides with the axis of rotation, and by reason of its inertia, the mass tends to turn at uniform speed. The housing, however, is subject to the same small fluctuations of angular velocity as

(*Continued on page* 1221)

Producing the C.A.V. Type DPA Diesel Fuel Distributor Pump

Some Further Examples of Methods and Equipment Employed at the Rochester Works of C.A.V., Ltd.

By A. W. ASTROP, Associate Editor

A PRODUCTION RATE between 5,000 and 6,000 per week is being maintained at the Rochester Works of C.A.V., Ltd., for the DPA distributor pump for diesel fuel, and an article in MACHINERY, 99/1060—8/11/61, described briefly the design of the pump, the basic principle of operation, and some of the methods and equipment employed for producing the rotor. This component incorporates a pair of in-line opposed plungers, which serve to pump the fuel through the bore to the distributor ports, and close tolerances are specified for the dimensional and geometrical accuracy of the plunger bore and shank portion. The rotor revolves inside a barrel, which is lined with a hardened steel sleeve, and some typical operations involved in the production and assembly of these two parts are considered in this article.

In Fig. 1 are shown the items which comprise what is termed the "hydraulic head" of the pump, namely, the rotor, barrel and sleeve, and a completely assembled unit is seen at the top right. The sleeve is made to be an interference fit inside the barrel, and the latter is heated by special Delapena equipment to facilitate the assembly operation. Since the various ports are drilled prior to assembly, it will be appreciated that special provision must be made to ensure the correct angular relationship between the two parts, within close limits.

OPERATIONS ON THE BARREL

The barrel is made from a billet of free-cutting mild steel, and at the first operation, the major diameter and the adjacent face are turned on a B.S.A. single-spindle chucking automatic. This machine is linked by a gravity-type conveyor with a number of Wickman multi-spindle chucking automatics whereon the reduced-diameter portion, an O-ring groove in the major diameter, the other end face, the bore, and a recess for an oil seal at the small end are machined. The barrel is now of the required overall length, the limits for this dimension being +0, −0·15 mm. (+0, −0·006 in.).

After stabilizing treatment, the barrel is next

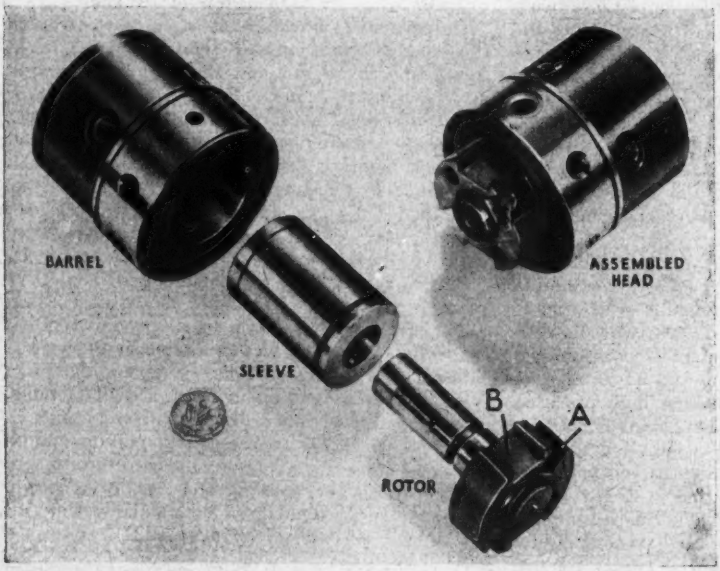


Fig. 1. The components which make up the "hydraulic head" of the DPA distributor pump. A complete assembly is seen at the top right

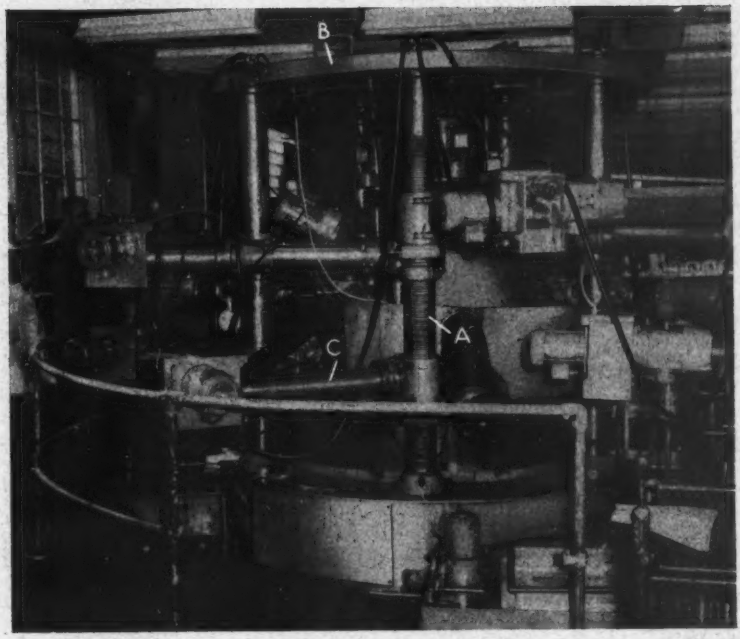


Fig. 2. A general view of the German-built Otnima special-purpose machine which is installed for multiple drilling, reaming, and tapping operations on barrels for DPA distributor pumps

centreless ground on a Scrivener machine. The two diameters are ground simultaneously, and the larger is held to limits of −0, +0·001 in. Ex-Cell-O machines are then employed for fine-boring the barrel, and for this operation the part is located from the ground major diameter and is clamped axially against the adjacent end face. Concentricity between the bore and the major diameter must be held within 0·01 mm. (0·0004 in.) total indicator reading.

OTNIMA MACHINE FOR MULTIPLE DRILLING OPERATIONS

The next stage in the production sequence provides for drilling and tapping a number of longitudinal, transverse and angular holes in the barrel, and these operations are carried out on a German-built Otnima machine (Henry Pels & Co., Ltd.). A pair of these machines has been installed by the company, one of which is set up for multiple operations on barrels, and the other for similar work on sleeves. A general view of the machine for barrels is shown in Fig. 2.

Otnima Werke, Guthschlag & Co., Tubingen, Germany, make a range of standard machine elements and unit heads from which special-purpose machine tools can readily be built up, and it is intended that such machines should be dismantled, and the component parts stored, when they are no longer required for particular applications.

One basic arrangement which can be obtained in this manner is the rotary-transfer machine, as employed by C.A.V., Ltd. As can be seen in Fig. 2, the machine has a circular cast iron base from which project six cylindrical steel pillars, one being indicated at *A*. The tops of these pillars have reduced-diameter, threaded portions, which pass through holes in a large-diameter cast-iron ring member *B*. Two threaded rings are provided for each pillar, one above and one below the ring member *B*, and with this arrangement the complete assembly is locked securely to form a rigid structure.

Each pillar is provided with rack teeth, and carries one or two cast-iron brackets which can be adjusted vertically by means of pinions. These brackets serve to support 6-in. diameter, hollow, cylindrical steel bars, as at *C*, which are arranged horizontally and can be adjusted axially. At the inner (table) end of each bar there is a quill-type spindle unit, the mounting of which provides for 360 deg. of angular movement in two planes, mutually at right-angles. Attached to the other end of each bar there is a feed box unit, which provides the drive to the spindle quill and incorporates a drum that is turned at a slow speed. On the periphery of this drum there is a number of dogs, which can be set to operate limit switches within the casing of the feed unit. The switches control the rapid approach, feed, and rapid return movements of the spindle quill, and drive for these movements is transmitted by a shaft which extends through the bore of the bar *C*.

It will be appreciated that with this arrange-

Fig. 3. Close-up view of the working zone on the Otnima machine

ment for mounting the spindle heads, the latter can be set in an unlimited number of positions, within the confines of the machine, so that the tools can approach the work from virtually any angle. A close-up view of the work-table of the Otnima machine, from the operator's position, is given in Fig. 3, where a number of the spindle heads, set to approach the work from a variety of angles, is clearly seen. There are seven work-holding fixtures on the table, equally-spaced around the periphery, and the spindle heads are grouped to provide six working stations. At the seventh position, in the foreground in Fig. 3, the fixtures are loaded and unloaded.

Around the inside of the ring member which secures the pillars there is a 1-in. bore pipe, indicated at *D* in Fig. 3, which delivers coolant from a separate pump and sump unit. Connections are made at various points on this pipe, and flexible tubes are provided to carry the coolant to the required positions adjacent to the tools. At the right in Fig. 3 can be seen a small pillar-mounted air tool, which is used by the operator to perform a simple de-burring operation on each barrel, during the automatic cycle of the Otnima machine. For this operation, the barrel is supported by a V-block secured to the base of the pillar.

The work-holding fixtures on this machine are shown more clearly in the close-up view Fig. 4, which is taken from a position just to the left of that normally occupied by the operator. Two barrels, in the condition in which they leave the Otnima machine, are indicated at *E*, and the design of the empty fixture at the right of these workpieces can be observed. The barrel is loaded horizontally, with the large end away from the operator and location is taken from the periphery of the larger diameter, and from the adjacent end face. The front wall of the fixture incorporates a specially-shaped block, which projects within the bore of the barrel and carries a hardened steel bush. This bush serves to steady a small-diameter drill which is employed to machine an angular hole that starts in the bore of the barrel and breaks into a larger radial hole (for the metering valve) drilled in the large-diameter portion. The angular hole is at 31 deg. to the centre line of the barrel, and the drill is mounted in a spindle-head arranged below the level of the table. This drill enters by way of the bore of the barrel, and passes through the guide bush before it contacts the work. The point at which the angular hole breaks out into the metering valve bore is required to be held within $\pm 0{\cdot}004$ in. of the specified position in the vertical plane.

Other guide bushes in the fixture are indicated at *F* and *G*, and it may be noted that the latter is employed in connection with the machining of the radial metering valve hole in the barrel, at the large-diameter end. The first operation on this hole is carried out by a twist drill, and the spindle head incorporates a steady bush which enters a hole in the bush *G* before the drill touches the work. When the hole has been drilled, the head, and with it the steady bush, is retracted, and at a subsequent station the hole is reamed, by a tool which passes freely through the bush *G*.

The barrel is clamped in the fixture by means of the lozenge-shaped plate *H*. This plate is carried on a pair of cylindrical guide bars which

can be moved axially by means of the lever *J*. To clamp the work, the lever is turned to advance the plate *H*. This movement serves also to extend a rod which projects from the back of the fixture and is provided with a mushroom head, as at *K*. A limit switch *L* is thus closed, and the automatic cycle of the machine cannot be started until this circuit has been completed. It may be noted that the switch *L* is attached to the bottom of a rod which extends vertically downwards from the superstructure of the machine, and is held about 1 in. above the table surface. The clamp plate *H* also serves to hold four guide bushes for the drills which machine tapping size holes in one end of the barrel, and these holes are subsequently tapped at another station. The spindle head *M* is arranged to approach the work vertically, from beneath, and provides for tapping a hole opposite the metering valve bore. For drilling this hole there is a similar head at the previous station.

Some of the limits specified for the sizes and positions of holes drilled, reamed and tapped on the Otnima machine are close. For example, the diameter of the metering valve bore (after reaming) must be within −0, +0·0009 in.; and the tolerance for its position in all planes is 0·0012 in. Also, the starting position of the angular hole in the bore of the barrel must be within ±0·002 in., in a plane parallel with the longitudinal centre line of the part. It may be noted that for some versions of the DPA pump, for "low-load" engines, a second angular hole is required connecting the bore of the barrel with the metering valve bore. This hole is drilled on the Otnima machine by the addition of another spindle head.

Barrels are next transferred to a Nassovia TransferRotor machine (Drummond Asquith, Ltd.) on which the outlet ports in the reduced-diameter portion are drilled, tapped and spot-faced. The number of outlet ports depends on the number of cylinders in the engine which the pump is to supply, and their angular positions are required to be held within ±1 deg. in relation to the metering valve bore. After thorough washing, the barrels are passed to a Funditor roll-marking machine, on which several identification numbers are impressed on the periphery of the reduced-diameter portion, and are then cyanide hardened. After this operation, they are chemically blacked all over, and are passed to a Keighley internal grinding machine, on which the bores are brought to within 0·0012 in. of finished size.

Subsequently, the bore is enlarged to the finished size by honing, on a Jones & Shipman Micromatic machine. At this operation, the bore is held to a tolerance of 5 microns (0·0002 in.) for taper and ovality, and to a surface finish of 12 micro-inches. Concentricity between the periphery of the large-diameter portion and the bore must be within 0·0004 in., total indicator reading.

The barrel is now ready for assembly with the sleeve, and since an interference fit is specified for these parts, and their angular relationship must be held within fairly close limits, special equipment is installed for the purpose. Before describing this equipment, some selected stages in the production of the sleeve will be considered.

Made from Nitralloy bar stock, the sleeve is first turned, drilled and parted-off on one of a battery of Wickman multi-spindle automatics, and depending on whether it is for a low- or high-load pump a small annular groove is machined, or omitted, at

Fig. 4. Fixtures for holding the barrels on the Otnima machine are here shown loaded and unloaded (*E*)

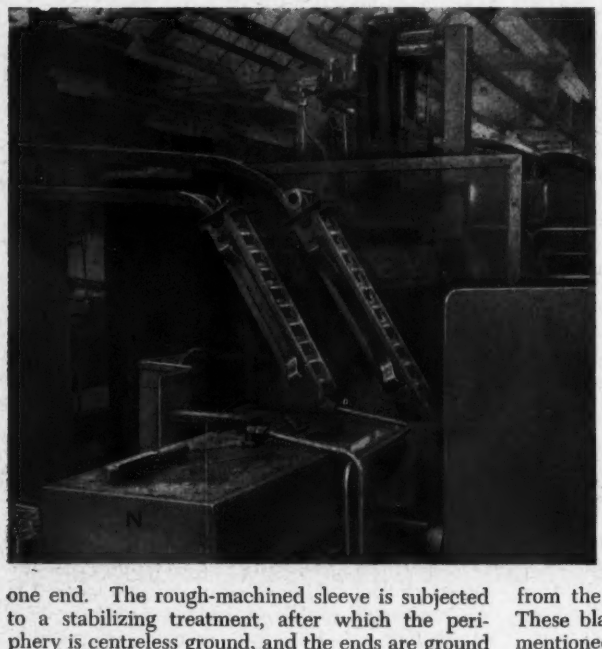


Fig. 5. Sleeves are fed by way of two chutes to an Ex-Cell-O twin-spindle machine for fine boring operations

one end. The rough-machined sleeve is subjected to a stabilizing treatment, after which the periphery is centreless ground, and the ends are ground square, by conventional means, on standard machines.

FINE-BORING SLEEVES ON AN EX-CELL-O MACHINE

From the face grinding operations, the sleeves are passed, by way of chutes, to an Ex-Cell-O fine boring machine, which is equipped for automatic loading, unloading, and gauging. On this machine, the sleeves are bored two at a time, and a view from the rear, showing the two input chutes, is given in Fig. 5. At the beginning of each cycle, a sleeve is taken automatically from the bottom of each chute and is lowered to a position in line with the boring spindles. Beneath the cover *N* there is a hydraulically-operated mechanism, which is actuated in synchronism with the machine cycle and serves to thrust the two sleeves axially into the work-holding collets.

A view from the operator's position is given in Fig. 6, where a pair of sleeves can be seen in the collets, one of which is indicated at *P*. The collets are closed pneumatically and the work-head is then automatically advanced to feed the sleeves over the rotating boring bars, one of the latter being seen at *R*. At the end of the boring pass, the work-head is retracted to the position shown and a special cradle *S*, with twin seatings, is lowered vertically. The seatings in this cradle are cylindrical, to suit the outside diameter of the sleeve, and a slot milled in each seating—at the 12 o'clock position—breaks into the bore. The cradle is lowered, and subsequently raised, by the hydraulic cylinder *U*.

As the work-head reaches the fully-retracted position, the finish-bored sleeves are thrust from the collets by the entry of the next pair, and pass into the bores in the cradle. Before the work-head advances again, the cradle is raised, to bring the sleeves in line with a pair of gauging mandrels within the casing *T*. As the work-head is advanced for the next cycle, a pair of blades, one of which is indicated at *V*, push the sleeves from the cradle and on to the gauging mandrels. These blades pass through the slots in the cradles mentioned above.

Of the air-gauging type, the mandrels and associated equipment were supplied by Mercer (Air-gauges), Ltd., and the panel, which incorporates two large-diameter dials and a number of pilot lights and control switches, is seen at the left in Fig. 6. The gauges are graduated in 0·001-mm. (0·00004-in.) divisions and provide a visual indication of the size of each bore in relation to the nominal diameter. The three pilot lights at *W* are labelled "high," "O.K." and "low." If a bush (or bushes) is bored over- or under-size, the high or low lamp is illuminated, and the machine cycle is automatically interrupted. The lamp remains illuminated, and the operator can refer to the dials to ascertain which tool requires adjustment, and by what amount.

When the work-head withdraws at the end of the cycle, the sleeves are automatically stripped from the gauging mandrels. The curved arms *X*, which are pivoted at one end, are then automatically turned through a small angle, to push the sleeves into the mouth of a chute, whereby they are discharged from the machine. From the Ex-Cell-O borer, the sleeves are passed to another Otnima machine, of generally similar construction and layout to that described in connection with operations on the barrel.

On this second Otnima machine, two $\frac{1}{16}$-in. diameter cross-holes are drilled, one of which is sub-

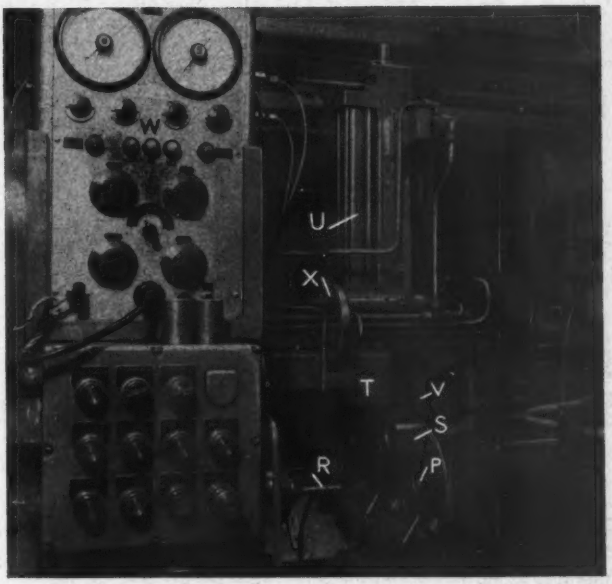


Fig. 6. A view of the Ex-Cell-O machine showing the equipment whereby the sleeves are raised to a gauging position

sequently aligned with the metering valve bore in the barrel; also two 0·12-in. transverse holes, for venting.

In the longitudinal direction, a 4·5 mm. (0·177 in.) diameter by approximately 1½-in. deep hole is drilled and countersunk from one end, to break into one of the $\frac{5}{16}$-in. diameter holes, and at a succeeding station the mouth of this hole is reamed to 4·7 mm. +0·02, −0 (0·185 in. +0·0008, −0) to a depth of approximately ⅝ in. When the pump is assembled, this hole serves to connect the transfer pump chamber to the metering valve, and for this purpose, the size and position are relatively unimportant. It is, however, utilized for location, at subsequent operations, and is therefore reamed to the limits quoted above. In addition, the centre distance from the bore of the sleeve is held within ±0·0014 in.

MOLLART SPECIAL PORT DRILLING MACHINE

This hole is employed, for example, to locate the sleeve when it is loaded into a special Mollart machine, on which the four delivery ports, also the inlet port, are drilled at one setting. A close-up view of the working zone of this machine is given in Fig. 7, where the five unit-type spindle heads can be seen. The head in the bottom left-hand corner serves to drill the inlet port hole, and is set slightly above the remaining four, which are all at the same height and are positioned accurately at right-angles to each other. This machine is somewhat similar in design and layout to that employed for port-drilling operations on the rotor, as described in the previous article.

The sleeve is mounted vertically, in a nest, in the bottom of which there is an upwardly-projecting peg which enters the mouth of the 4·7-mm. diameter hole. Angular location relative to the metering valve bore is thus ensured, and the sleeve is clamped axially by the triangular plate *A*, which is mounted on vertically sliding pillars, and is pulled down hydraulically, by a cylinder in the base of the machine. The nest incorporates a

Fig. 7. Close-up view of a special Mollart machine for drilling ports in sleeves

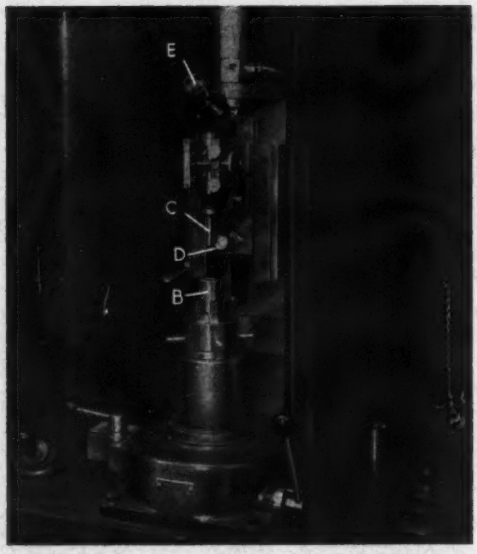


Fig. 8. This special instrument, incorporating Taylor, Taylor & Hobson optical equipment, is employed for checking the port positions in sleeves

number of hardened guide bushes, and the spindle heads are arranged to advance simultaneously, so that all five holes are drilled at once.

It may be recalled that maximum positions are specified for the edges of the ports in the rotor, in terms of deg. and min. from the centre-lines. Similar requirements apply to the ports in the sleeve, except that in this instance it is the positions at which the ports break into the bore that are important. In a plane at right-angles to the centre-line of the sleeve, the angle subtended by the edge of any port, where it intersects the bore, and the centre line of that port must not exceed 7 deg. 30 min.

The spindle heads are of the cam-operated type, and step-by-step feed is applied in order to clear swarf from the holes. It may be noted that the ports must be held to the specified diameter within limits of $+0{\cdot}003$, -0 in. Special inspection equipment has been installed for checking the positions at which the ports break into the bore, and a close-up view of the unit is shown in Fig. 8. It is housed in an enclosure, which serves to exclude most of the extraneous light, and is located in the production line fairly close to the Mollart machine just described.

The unit incorporates optical equipment, supplied by Taylor, Taylor & Hobson, and there is a nest in which the sleeve is mounted vertically, and located angularly, in the same manner as on the Mollart machine. A sleeve is seen in position at *B*, and it will be noted that the upper edge of the nest is castellated, to expose the ports which are to be checked. The nest can be indexed, to four positions at 90 deg., and is turned by hand by means of the four short rods projecting from the periphery.

The optical equipment is arranged to slide on a column, at the rear of the nest, and is raised and lowered by the double-acting air cylinder seen at the top. It incorporates a probe *C*, which is lowered into the bore of the sleeve, and a light source *D*. The probe has a small mirror at the lower end, which is set at 45 deg. to reflect light vertically upwards, and the light source *D* is accurately positioned opposite to the mirror.

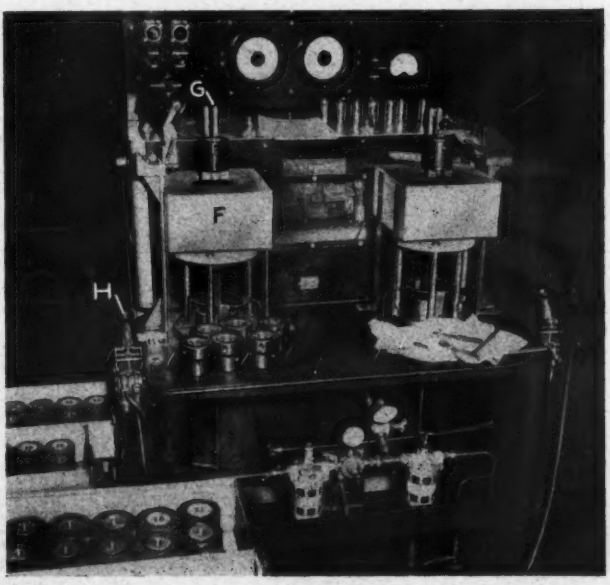


Fig. 9. Two-station Delapena automatic machine for assembling sleeves to barrels

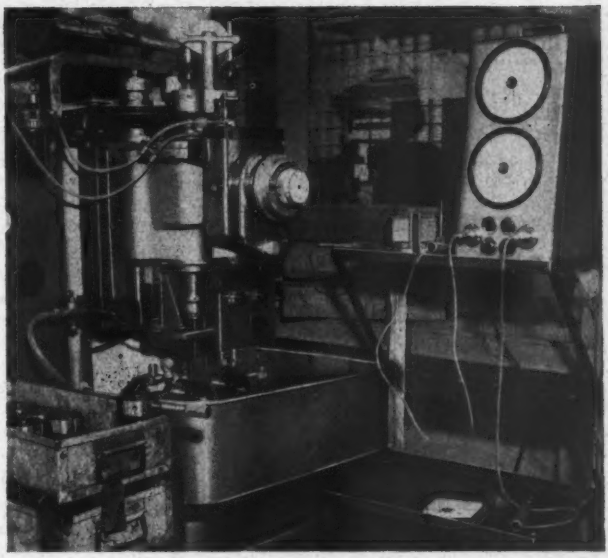


Fig. 10. Set-up on a Jones & Shipman Micromatic machine for honing the meter valve bore in the barrel

The slide which carries the probe and light source is lowered to a predetermined position, against a dead stop. Light from the source *D* thus passes through one of the ports, and an image of the mouth of the port in the bore is reflected upwards into the eye-piece *E*. This eye-piece incorporates a graticule with a square formed by four thin black lines, and if the port being checked has been machined in the required position the image of its mouth will fall within the square. Should the image overlap the square at any point, the sleeve is rejected. The nest is indexed to enable each port in turn to be checked.

After this inspection, accepted sleeves are nitrided, the treatment being similar to that applied to rotors and briefly described in the previous article. After heat-treatment, the end faces of the sleeve are ground to bring it to the required overall length within limits of +0, −0·03 mm. (+0, −0·0012 in.), and the faces must be square with the bore to within 0·0005 in. total indicator reading. A surface finish of 5 micro-inches is specified for these faces.

Subsequently, the outer surface of the sleeve is centreless ground on a Cincinnati machine, and must be round and straight within 0·0002 in. total indicator reading. At this stage, the sleeves are graded for external size, so that a selective procedure can be followed for subsequent assembly to the barrel. Finally, the bore is ground on a Voumard machine, to a 10 micro-inch finish and to similar limits for roundness and straightness as are specified for the outer surface. The concentricity of the bore with the outer surface is now checked, and must be within 0·0005 in. total indicator reading.

DELAPENA HEATING AND ASSEMBLING EQUIPMENT

The special twin-station heating and assembling equipment which is employed for inserting sleeves into barrels is shown in Fig. 9. Supplied by Delapena & Son, Ltd., the machine has two identical working stations which are used successively and continuously, and is tended by one operator. Referring to the left-hand station, the box *F* encloses an induction heating coil of a diameter sufficient to embrace the outer surface of a barrel. Behind this coil, and projecting vertically upwards, there is a forked member, as at *G*, which is made from high-conductivity copper.

At the start of the operation, a stainless-steel peg is inserted by the operator into the meter valve bore of a barrel, and a portion of this peg projects radially. The barrel is then placed in a nest, which is supported by an air-operated ram, and the stainless-steel peg is engaged between the limbs of the fork. By actuating the air valve *H*, the ram and nest are lowered to bring the barrel within the induction heating coil. The barrel is supported in this position, but the ram continues to move downwards to a position almost level with the table-top of the equipment.

A sleeve of the required grade to suit the bore of the barrel is then placed in the nest, being located by the bore and positioned angularly by a pin which enters the 4·7-mm. diameter hole in one end. After a predetermined period, controlled by the dial-type timer at the left in the background, the barrel has been heated sufficiently to ensure the required amount of expansion. The ram is then automatically raised, and the sleeve is carried upwards and thrust rapidly into the bore of the barrel. Continued upward movement of the ram raises the complete assembly clear of the coil, which has automatically been switched off, to the position shown

in the figure. After loading the other working station, and starting the cycle, the operator returns to the left-hand position and removes the barrel assembly with the aid of tongs. The electrical circuit is arranged in such a manner that both heating coils cannot be energized simultaneously.

After stabilizing treatment, the barrel assembly is passed to a Precimax machine on which the major diameter portion is ground and the O-ring groove is cleaned up to restore concentricity.

HONING THE METER VALVE BORE

At one of the last operations on the barrel assembly, the meter valve bore is honed. A Jones & Shipman Micromatic single-spindle machine is employed in conjunction with a transfer-type fixture. This fixture has two adjacent seatings and is arranged to slide, to bring either seating beneath the machine spindle. With this arrangement, honing is carried out on a barrel while unloading and loading is performed at the other seating of the fixture.

A general view of the Micromatic machine is given in Fig. 10, and the barrels are loaded with the bores horizontal, and the meter valve holes facing upwards. Diamond honing sticks supplied by Diagrit Diamond Tools, Ltd., are employed, and the meter valve bore is brought to the required size within 0·0002 in., and to a surface finish of 15 micro-inches.

In the fixture, the barrel is seated in a V-block and is located by passing a ground plunger through a guide bush supported above, and introducing it into the meter valve bore. With the plunger in position, a V-type side clamp is applied, and the plunger is then withdrawn. The fixture is mounted on ball-bearing ways, and is free to float under the control of the honing tool. Mercer air gauging equipment, as seen at the right, is used to check the meter valve hole for size, straightness, and roundness.

Further articles on methods and equipment employed by C.A.V., Ltd., for the production of DPA pumps will be published shortly in MACHINERY.

Monomer Casting Process for Nylon

A new process known as monomer casting has been announced by Polypenco, Ltd., Welwyn Garden City, for the production of nylon parts of considerable mass. The basic chemistry involved in the process was discovered by the Monsanto Chemical Co., and Polypenco, Ltd., through the parent organization—The Polymer Corporation, Reading, Penn., U.S.A.—have acquired the exclusive rights in connection with the casting of shapes in the United Kingdom and many other countries.

This 4½-ft. diameter gear was produced from Polypenco MC nylon by the monomer casting process

The process is carried out at atmospheric pressure and is similar in many respects to conventional metal casting. Expensive moulds are not required, and direct production of parts from monomer eliminates various steps in the processing cycle, and is said to enable large components to be made at lower cost than hitherto.

A type 6 formulation know as MC nylon is employed, and it is claimed that the castings are substantially cheaper than those of stainless steel and brass, and are competitive with those of alloy steels. It is forecast, moreover, that with an increase in the volume of production and further development of methods, it may be possible to compete with carbon steel and aluminium castings.

Semi-finished symmetrical shapes with weights ranging from 500 to 700 lb. have already been cast, and it is anticipated that considerably larger parts may be produced in the future.

Potential applications, it is stated, include castings for metal-working equipment, railway equipment, paper-making machinery, mining machinery, and mechanical handling equipment, where advantage can be taken of the properties of lightness, toughness, and wear resistance without lubrication.

Design of Negative Rake High-speed Steel Tools for Planing*

By P. H. MILLER, A.M.I.E.Aust., A.M.I.Prod.E.

ALTHOUGH MUCH RESEARCH WORK has been carried out in connection with metal cutting processes and the information thus afforded has been widely disseminated, it appears that a relatively insignificant amount of the knowledge gained has been absorbed at workshop level, and that a still smaller amount has been applied. It seems, indeed, that the art of cutting metals is still very much an art, and that the design of single-point tools, in particular, is largely empirical or traditional. These remarks apply especially to tools used on general purpose lathes, and shaping, planing, and slotting machines. Presumably on account of the apparent simplicity of these tools, the maintenance of theoretically correct angles, if they are known, is often neglected.

In the writer's experience, the design of tools for planing and shaping, in particular, has received insufficient attention. An investigation was therefore carried out primarily in connection with planing operations, and because the two machines available could only be used at comparatively slow speeds, efforts were made to improve metal removal rates by modification of tool form.

Within the limits set by: (*a*) reasonable tool life; (*b*) the power and rigidity of the machine; (*c*) the work holding arrangements; and (*d*) the shape, machinability, and rigidity of the workpiece, the maximum rate of metal removal requires maximum depth of cut, maximum feed per stroke, and maximum cutting speeds.

Since cutting speeds were limited to 40-50 ft. per min. on the machines available, it was decided to use high speed steel tools, and to modify the geometry to enable chip cross sectional areas to be increased.

TOOL FORM FOR MAXIMUM DEPTH OF CUT

When machining "difficult" workpieces, and particularly rough and irregular castings in alloy steels, planing tools are subjected to severe conditions, and those of conventional form are frequently damaged, or wear rapidly, even when cutting speeds are reduced to abnormally low values. If the operation of a conventional planing tool is considered, it will be evident that the initial impact between tool and work is borne by the point, which is the weakest part. Often a compromise is sought by increasing the radius of the point to obtain a "round nosed" shape, but such a form is inherently inefficient, particularly for roughing cuts.

In order to relieve the tool point of the initial impact on entering the cut, it is recommended that all roughing tools should have negative rake.

Fig. 1 shows the weakness of the conventional positive rake tool as compared with the tool which has negative rake. With a negative rake tool, the point of initial impact recedes from the tool point with increasing depth of cut as illustrated in Fig. 2.

It follows that provided the machine, work holding clamps, and tool shank are sufficiently robust, it

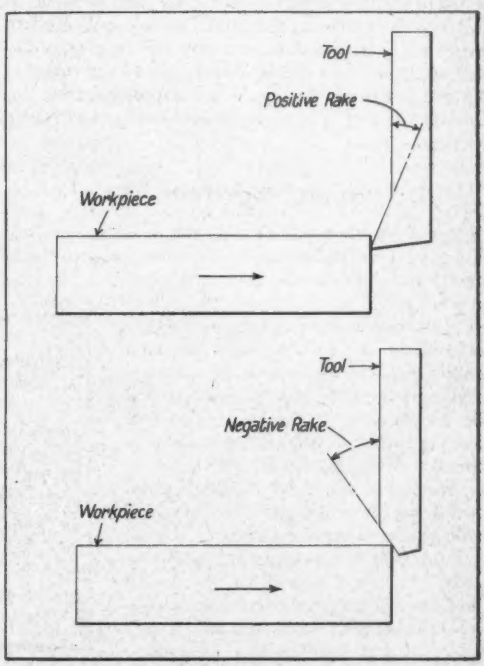


Fig. 1. Diagrams showing planing tools with positive and negative rake

* The negative rake tools illustrated in this article are the subject of Australian patent application, No. 7455 61.

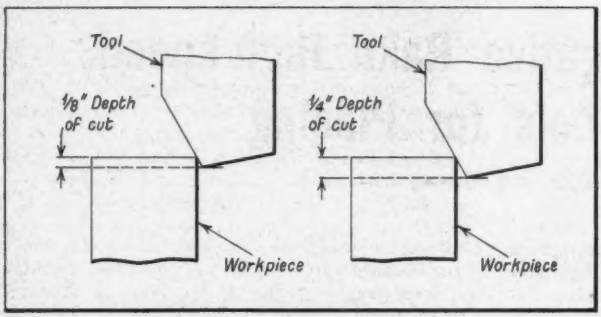


Fig. 2. With negative rake, the deeper the cut the further is the point of initial impact from the tool point

is better to take deep roughing cuts than shallower cuts, particularly on materials of low machinability. These deep cuts, it should be noted, offer advantages quite apart from considerations of tool wear which make it desirable to cut beneath the abrasive "skin" of a rough casting.

For a given depth of cut, the distance d, of the point of impact from the tool point will increase as the negative rake angle increases, as indicated in Fig. 3. For materials of very low machinability this angle can be increased to values of the order of 45 deg. in order to obtain a reasonable value for the distance d when depth of cut is necessarily reduced.

TOOL FORM FOR MAXIMUM FEED

For a given depth of cut, the cutting force increases as the feed is increased, since the chip thickness and sectional area increase accordingly.

Referring to the sketch on the left in Fig. 4, if the "plan" approach angle of the tool is zero, the feed f and undeformed chip thickness t will be identical. If, however, the tool has an approach angle P, as shown in the sketch on the right, $t = f \cos P$.

Assuming identical cutting speed and feed, the rates of metal removal will be the same in both cases since,

area of cut (left-hand sketch) = $x \times t = x \times f$,

area of cut (right-hand sketch) = $x/\cos P \times t = x/\cos P \times f \cos P = xf$.

The total cutting force will be the same for both tool forms but because the cutting edge applied to the work is longer, the cutting pressure (force per inch length on the tool edge) is reduced when the approach angle P is increased. Also a greater length of tool edge is available to conduct heat.

When an approach angle is ground on the tool the combination of reduced cutting pressure and improved heat transfer from the cutting edge enables larger feeds to be used. If undeformed chip thickness is maintained at t, with an approach angle on the cutting edge, chip area and metal removal rate are increased. It has been established by Schlesinger that specific cutting resistance decreases with increased chip area. For example, he ascertained that the specific cutting force (cutting force per 0·001 sq. in.), for a particular 35-40-ton steel, was 240 lb. for a chip area of 0·00155 sq. in. but fell to 220 lb. when the chip area was doubled. It follows that an increase in the approach angle should enable the rate of feed to be increased without reducing tool life appreciably.

When square shoulders are to be machined, a tool with zero approach angle must necessarily be used. For general roughing work, however, to enable maximum feeds to be applied, a reasonable "plan" approach angle (15 deg. or more) should be adopted. For materials of low machinability, the approach angle may be increased to 30 deg. or more, to enable a reasonable feed rate to be employed.

In the foregoing, only the direct effects of approach angle on chip thickness and cutting pressure on the tool cutting edge have been con-

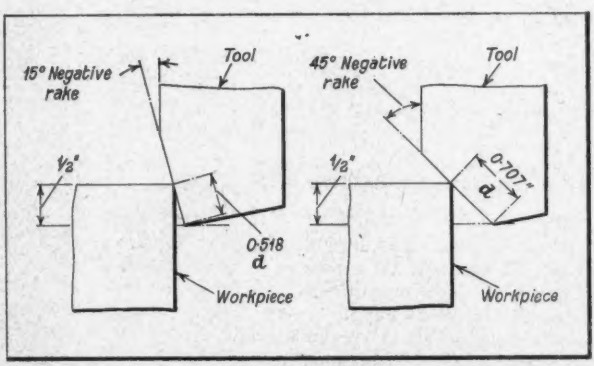


Fig. 3. For a given depth of cut, the larger the negative rake angle, the farther is the initial point of impact from the tool point

sidered. It is necessary to bear in mind, however, that the approach angle has a pronounced influence on the effective rake angle of the tool. For example, a tool with a back rake of −20 deg., a side rake of 10 deg. and zero approach angle, has a positive effective rake of approximately 15 deg. If an approach angle of 30 deg. is ground on this tool, the positive effective rake is reduced to about 6½ deg.

MAXIMUM CUTTING SPEED

As far as the cutting tool is concerned, the principal factor limiting cutting speed is the temperature reached by the cutting edge. The temperature of the cutting edge depends upon the rate of generation of heat and the rate at which it is conducted away from the edge. The rate of generation of heat is proportional to the rate at which mechanical work is dissipated at the tool, that is:—

Rate of generation of heat = cutting resistance × cutting speed = area of chip × K × cutting speed = feed × depth of cut × K × cutting speed.

For given values of feed and depth of cut, it follows that, if high cutting speeds are required, efforts must be made to reduce the constant K which depends on factors such as the hardness and machinability of the work material and the effective rake angle of the tool.

It has been proved in the laboratory, and in everyday shop practice, that for a given material cutting resistance decreases rapidly with increase in positive effective rake. Thus, to reduce cutting resistance and consequently the rate of heat generation, it is necessary to provide the tool with a positive effective rake.

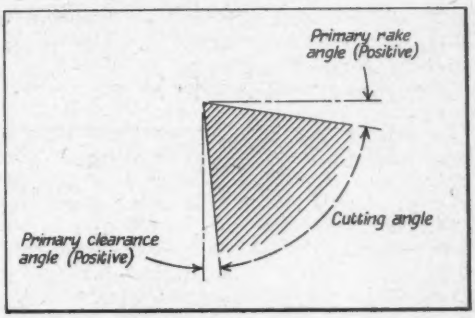


Fig. 5. This section of a planing tool is taken at right angles to the cutting edge and normal to the rake face

Heat, however, is conducted away from the cutting edge mainly by the chip and the body of metal in the tool immediately adjacent to the edge. Normally, it would be expected that increase in positive rake angle would decrease the cutting (included) angle of the tool and thus reduce the sectional area of tool material available for conducting heat from the cutting edge. This aspect and the mechanical weakening of the cutting edge, limit the positive rake angle which can be ground on the tool.

To summarize, the characteristics of planing tool geometry for maximum economic rate of metal removal, are as follows:—

(*a*) For maximum depth of cut the tool should be designed with a negative rake.

(*b*) For maximum feed, an approach angle should be provided.

(*c*) For maximum cutting speed, the tool must have a positive effective rake, and at the same time retain a large cutting (included) angle to provide for adequate heat conduction and mechanical strength of cutting edge.

Obviously, any tool may be designed to incorporate a negative back rake and an approach angle as stated under (*a*) and (*b*), but at first sight, the conditions under (*c*) (large positive effective rake and large cutting angle) appear to be mutually contradictory.

Fig. 5 shows a section of a tool at right angles to the cutting edge and normal to the rake face, which affords

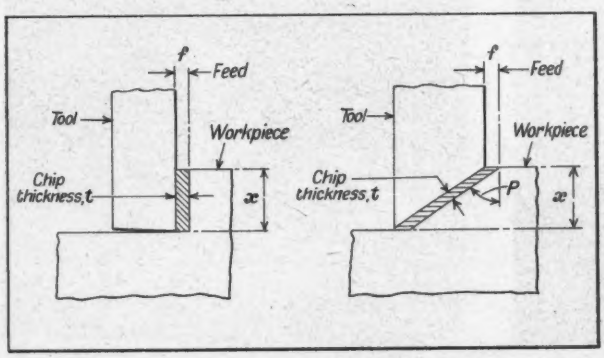


Fig. 4. Diagram showing how chip thickness, for the same feed, is reduced when there is a "plan" approach angle on the tool

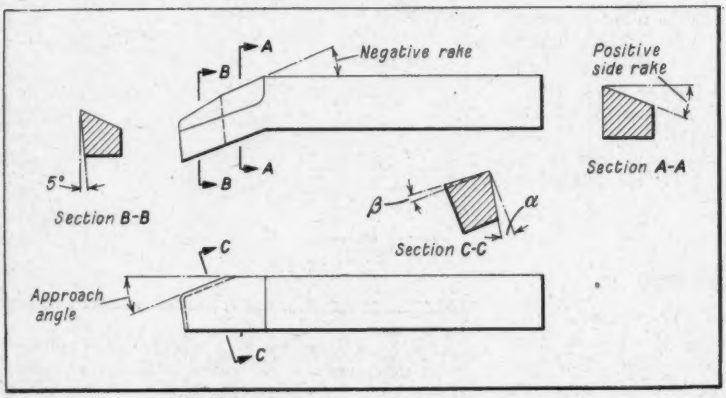


Fig. 6. A typical negative rake planing tool in front and side elevation. Section *CC* is taken at right angles to the cutting edge and normal to the rake face. α is the primary rake and β is the primary clearance, and is negative

an indication of the amount of metal adjacent to the edge for heat conduction, also of the mechanical strength of the edge. It will be evident that the cutting angle provided on such a planing tool is 90 deg. minus the primary clearance angle minus the rake angle.

On a negative rake planing tool with an approach angle, a reasonable "effective clearance angle" (the clearance angle measured relative to the surface generated on the work) may be obtained even if a negative primary clearance angle is provided for the cutting edge. This result is possible because, although the fact is not widely appreciated, the path of the chip is generally not at right angles to the cutting edge. It has been established by Stabler that the path of the chip across the rake face is determined by the inclination of the cutting edge relative to the work.

For the negative rake planing tool designed for normal duty, the primary clearance angle is $-3\frac{3}{4}$ deg. and the primary rake angle is 10 deg. Consequently, the cutting angle is

$$90 \text{ deg.} - (-3\tfrac{3}{4} \text{ deg.}) - 10 \text{ deg.} = 83\tfrac{3}{4} \text{ deg.}$$

A typical negative rake planing tool of this type is shown in Fig. 6.

The corresponding angles provided on a heavy-duty negative rake planing tool are $-10\frac{3}{4}$ deg. and 0 deg. For such a tool, therefore, the cutting angle is

$$90 \text{ deg.} - (-10\tfrac{3}{4} \text{ deg.}) - 0 \text{ deg.} = 100\tfrac{3}{4} \text{ deg.}$$

For each type of tool, the effective clearance

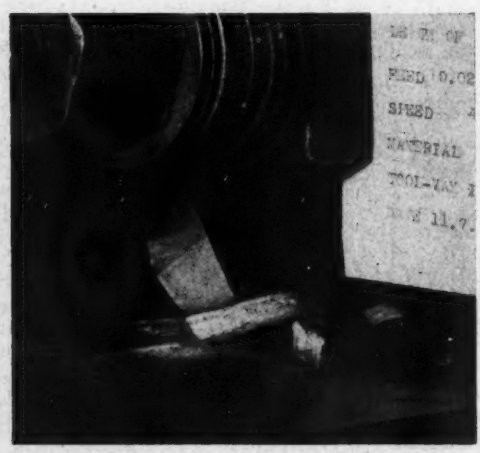


Fig. 7. A negative rake tool in operation on S.1040 steel. The cutting speed is 42 ft. per min., the feed 0·025 in., and the depth of cut, $\frac{1}{4}$ in.

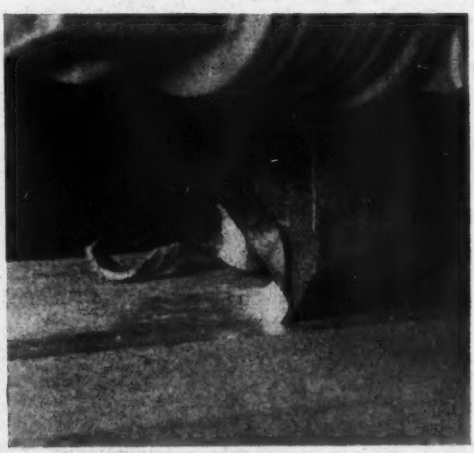


Fig. 8. This round-nose tool is planing S.1040 steel at 42 ft. per min., with 0·025-in. feed, and $\frac{1}{4}$-in. depth of cut

Fig. 9. Surface finishes obtained with 0·025-in. feed. *E*, *F*, and *G*—negative rake tools. 13—round-nose tool

angle is 5 deg. and each gives a generous positive effective rake.

In Fig. 7, a tool designed for "regular" service is shown in action cutting 45-ton B.H.P. steel S.1040 (Durax quality), in the as-rolled condition. The tool material is 18-4-1 grade high speed steel, and a ¼-in. deep cut is being taken, with a feed of 0·025 in., at 42 ft. per min.

Fig. 8 shows a conventional round-nose tool operating under the same conditions. This commercial butt-welded tool of well known make has a tip of super grade (12 per cent cobalt) high speed steel.

Several tools similar to that seen in Fig. 7 were run, each for a period of 20 min., and examples of the surface finishes obtained are shown in Fig. 9 at *E*, *F* and *G*. The area which is marked 13 was machined by the round-nose tool, and it is apparent that the edge failed early in the test.

In Fig. 10 a negative rake tool of "regular" type is shown cutting mild steel of 34 tons tensile strength, in the as-rolled condition. The tool material, again, was 18-4-1 grade high speed steel, and planing was carried out at 50 ft. per min. with a ¼-in. deep cut and a feed of 0·075 in.

Good results are being obtained with such tools in everyday workshop practice on rough alloy steel castings of low machinability and involving intermittent cutting. On workpieces of this type the superiority of tools with large negative back rake angles is quickly demonstrated, and depths of cut may be far beyond those which could be attempted with conventional positive rake tools.

Noticeable features with the negative rake tools are shock-free entry into the cut, regardless of depth, smooth flow of chips over the rake face, even texture of chips, and relatively cool cutting action which results in chips free from overheated areas or torn edges. Such conditions, naturally, are conducive to good surface finish and long tool life.

After extensive experiments with tools having various combinations of negative back rake, positive side rake and approach angle, efforts have been made to reduce the number of forms to two.

(1) Tools for regular work—for use on normal work materials.

(2) Tools for heavy duty—for use on alloy steel of low machinability.

Although a large approach angle is desirable from the standpoint of maximum metal removal, if the finished work is required to have square shoulders it is necessary to eliminate the approach angle. For this reason the two categories, above, have been sub-divided into:—

(*a*) Bevelled tools with an approach angle of the order of 30 deg.

(*b*) Straight tools with zero approach angle.

The elimination of the approach angle necessitates a change in the values of front rake and side rake, in order to maintain the desired values of effective rake and cutting angle.

Fig. 10. A negative rake tool in operation on mild steel. The cutting speed is 50 ft. per min., the feed 0·075 in. and the depth of cut, ‡ in.

K

In applying basic theory to cutting tool design, odd shaped tools, of which those in Fig. 7 and Fig. 10 are among the less extreme examples, will sometimes result, and difficulties will almost certainly be experienced in persuading operators to mount them correctly in their machines. The odd appearance of some of these highly successful tools should serve, however, to emphasize the validity of the theory on which their design is based, since it is hardly conceivable that such shapes and such performances could be arrived at by ordinary trial and error methods.

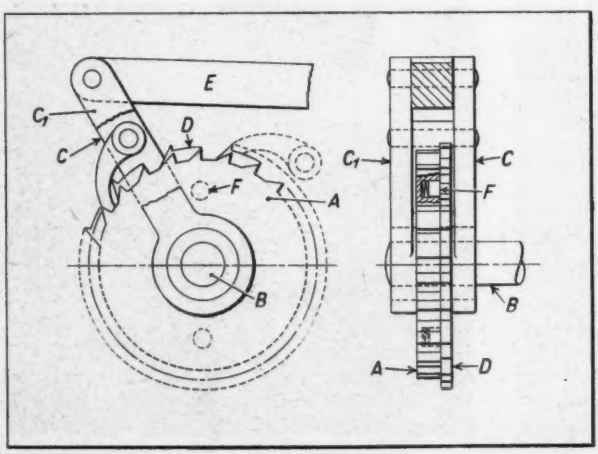
A Ratchet Mechanism for Alternate-stroke Operation

By L. KASPER

In the figure are shown part-sectional and side views of a twin-wheel ratchet mechanism which provides for partial rotation of a shaft at alternate strokes of the pawl only. During intermediate strokes, one ratchet wheel only is turned, but does not transmit movement to the shaft. One ratchet wheel, as indicated at *A* is of conventional design, except that the teeth are slightly more widely spaced than is usual. This wheel has a boss at each side and is secured by means of a key to the driven shaft *B*.

On one boss, a lever *C* is freely pivoted, and on the other boss there is a free-running ratchet wheel *D* and another lever C_1. A conventional pawl, wide enough to cover both wheels, is pivoted from a pin which connects the levers *C* and C_1, and the outer ends of the levers are connected to a reciprocating lever *E*. There are half as many teeth on the free-running wheel *D* as are provided on the wheel *A*, and they are of special form, as shown in the side view. In addition to the radial operating face, each tooth has a short arcuate surface, the radius of which is greater than that to the tips of the teeth on the wheel *A*. One end of this arcuate surface terminates in a radial face which is coincident with that of a tooth on the wheel *A*.

In the side view, the mechanism is shown at the end of a driving stroke, and it will be noted that the pawl is in contact with the radial face of one tooth on each of the ratchet wheels. When the reciprocating lever *E* returns to the starting position, the pawl is drawn back across the tips of the teeth on both wheels, and at the end of the stroke the nose of the pawl comes to rest on the arcuate portion of one tooth of the wheel *D*, and just behind one of its radial faces. It is thus held clear of the teeth on the wheel *A*, and at the next stroke of the lever *E* the wheel *D* only is turned. Since this wheel is free-running on the boss of the wheel *A*, no motion is transmitted to the latter.



A ratchet mechanism which imparts a turning movement to a shaft at alternate strokes of the operating pawl

At the end of the next return stroke, the pawl drops clear of the arcuate portion of a tooth on the wheel *D*, and is thus in a position to turn both wheels during the following working stroke. Both ratchet wheels must have an even number of teeth, and the stroke of the lever *E* must always cover an odd number of teeth. Small compression springs *F* are housed in pockets in the wheel *A*, and provide sufficient frictional resistance to prevent the wheel *D* from being turned backwards by the pawl during its idle stroke.

It may be noted that if arrangements are made for varying the stroke of the lever *E* at will, so that, on its return movement, it covers either an odd number or an even number of teeth, the shaft *B* can be driven at alternate strokes of the lever *E* or at consecutive strokes, as desired.

MACHINE TOOL BUILDING IN BRITAIN—2

William Asquith, Ltd., Highroad Well Works, Halifax

By P. A. SIDDERS, Chief Associate Editor

THE NAME OF ASQUITH has been associated for many years with machines for drilling and boring, and, in particular, with radial drilling machines of various designs. More recently, the company has established a reputation for very large horizontal boring machines of the ram type, also for multi-station special purpose and transfer machines. William Asquith, the founder of the company, was born in Halifax in 1840, and after serving an engineering apprenticeship, emigrated to British Columbia at the age of 20, and was there concerned with gold mining plant.

He returned to this country in 1865, and established a small machine tool works in the village of Highroad Well on the eastern outskirts of Halifax, on a site that provided ample room for future expansion. This site forms the nucleus of the existing works, and it may be of interest to note, that some of the original workshop buildings have only recently been demolished to make room for a heavy assembly bay, to be described later.

The range of machine tools built initially at the Highroad Well works included lathes (from very small to large types), planers, slotters, shapers, and milling, screwing, and drilling machines. From the start, efforts were made to build high quality, patented designs, and the firm acquired a reputation for machines that were at least the equal of those built at the then acknowledged centres of the machine tool industry. Machines were supplied to some of the largest engineering works in the country—including railway workshops, H.M. dockyards, and Government factories—and many were exported, the overseas markets at that time including the U.S.A.

Many improvements in the basic design of machine tools were introduced by William Asquith, and it is typical of his enterprise that, during a period of severe trade depression towards the end of the century, when he had a number of machine tools on his hands, he chartered a ship, and transported his stock to Russia, where he disposed of the whole consignment. A speciality developed

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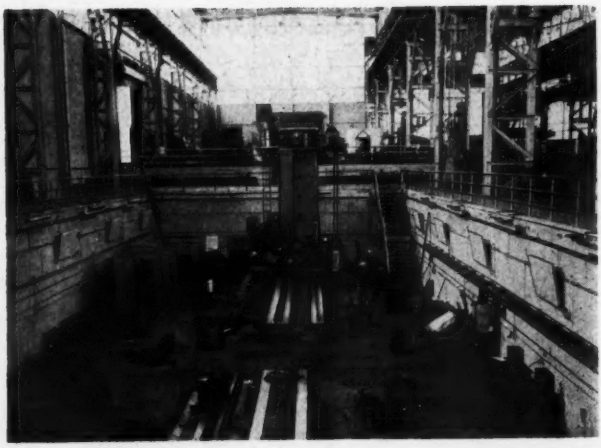


Fig. 1. General view of the erection pit in the new extra-heavy assembly shop at the works of William Asquith, Ltd. The pit is 140 ft. long, 44 ft. wide and 14 ft. deep, and the maximum distance from the floor of the pit to the hooks of the overhead travelling cranes in the shop is 50 ft. Three cranes are provided, with maximum lifting capacities of 75, 50 and 25 tons. The pit is intended for the building of very large machine tools, in particular ram-type boring and milling machines, and a 6-in. ram type borer is seen under construction, with the bed unit for a similar machine in the foreground

Fig. 2. One end of a 14-station in-line transfer machine under construction in heavy assembly bay of the Highroad Well works. The machine provides for operations on motor vehicle differential casings, and each workpiece makes two circuits. During the first circuit, with the casing mounted at one end of a 2-station platen fixture, the main opening is bored, the surrounding face is machined and chamfered, a side face is milled and holes in both faces are drilled, reamed and tapped. The work is then inverted and loaded into the other fixture station for the second circuit, which provides for rough and finish milling and boring the half-shaft facings, also drilling and tapping

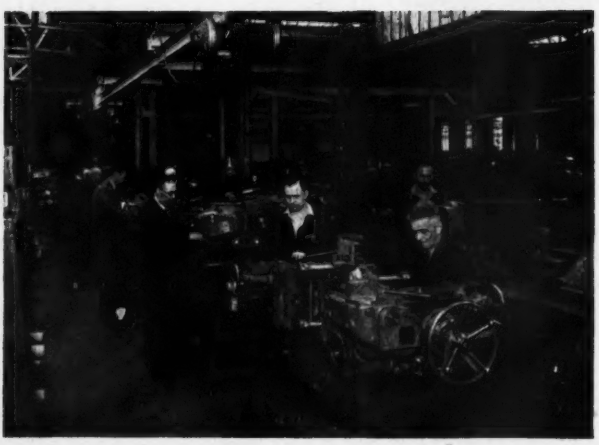


Fig. 3. Part of the line for building head sub-assemblies for Asquith type OD radial drilling machines, which are now being produced at a rate of about 30 per month at the Highroad Well works. Small details are built up at benches along one side of the section, and are assembled to the main head units which are supported on specially-designed floor stands. Power-operated hoists on a runway above the line of stands facilitates the movement of heavy components and completed sub-assemblies, which are transferred to the main machine building lines in the adjacent bay

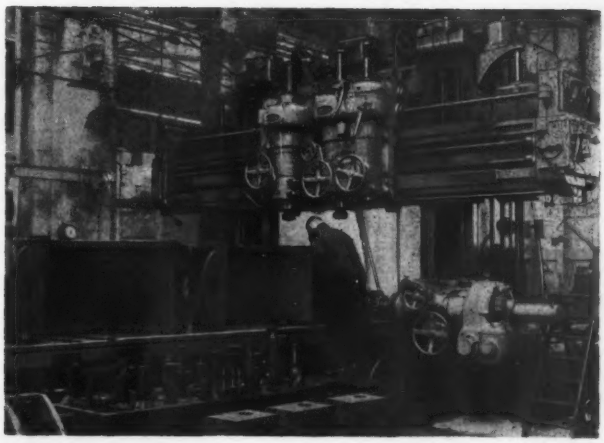


Fig. 4. This Asquith plano-miller, which was built in 1920, is installed in the heavy machining section of the Highroad Well works, and is still effectively employed for heavy metal removal operations. A side head is mounted on each upright, and on the cross rail there is a single-spindle head and a 2-spindle head. Tungsten carbide tipped cutters up to 15 in. diameter are employed. The machine table is 30 ft. long by 7 ft. wide, and workpieces up to 9 ft. high can be accommodated. Drive to the table is by rack and pinion, and the main drive motor is of 50 h.p.

Fig. 5. A number of planing machines is installed in the William Asquith Highroad Well works, the most recent addition being this large Butler openside type, which has a 16- by 5-ft. table, and will accept workpieces up to 6 ft. high. This planer has two tool slides on the cross rail and one on the column, each of which is normally fitted with a solenoid-actuated clapper box. The machine is here shown set up for planing the vertical elements of the T-slots in the support work-table for an Asquith girder end facing machine. Each slot is $1\frac{1}{16}$ in. wide by $2\frac{1}{8}$ in. deep, and for this operation the tool is lifted from the work by hand

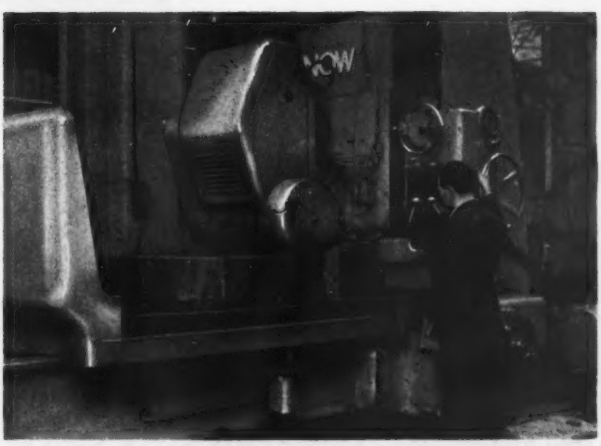


Fig. 6. This Snow PP 96 double-column surface grinder is one of two installed at the Highroad Well works, The grinding wheel is 20 in. diameter by 6 in. wide, and the machine will accept work up to 36 in. square by 96 in. long. Employed for finishing all mating faces on main components, the machine is seen set up for grinding a face of the slide unit for an Asquith HVB vertical borer. Table traverse speeds from 40 to 97 ft. per min. are provided by the hydraulic system, and the cross traverse rates are steplessly variable from 0 to $2\frac{1}{2}$ in. per table cycle. The speed of the wheel spindle is 1,000 r.p.m.

Fig. 7. This Czechoslovak TOS universal milling machine has been specially adapted by William Asquith, Ltd., for cutting feed racks for 6-in. light-duty horizontal borers. Index gears, a dividing plate and a locating plunger have been provided at one end of the table for rotating the feed screw, and one tooth is cut at a time. The cast iron rack has teeth of 2½ d.p., 20-deg. normal pressure angle, and 15-deg. helix angle. A right-angle head has been fitted, and the teeth are cut at a spindle speed of 35 r.p.m. and a feed rate of 1¼ in. per min. Smaller racks are cut on an automatic Reinecker machine

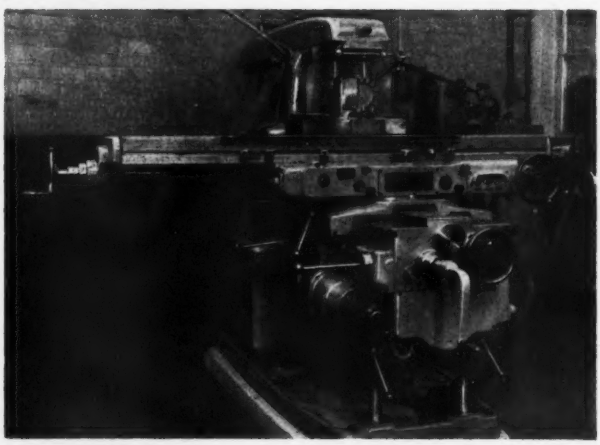


Fig. 8. The Russian universal milling machine here shown is installed in the Asquith toolroom, and is seen set up for operations on the lifting bracket for a large jig. Spindle speeds of 31 to 1,600 r.p.m. are available, and the 56- by 16-in. work-table has longitudinal and cross traverses of 28½ in. and 12 in., at feed rates from 1 to 52 in. per min. For the 15-in. vertical traverse of the knee, feed rates from ½ to 17 in. per min. are obtainable. The machine is arranged to operate on an automatic cycle, and when the power traverses are used, the hand-wheels can be immobilized by pushing in and turning a screw on the saddle

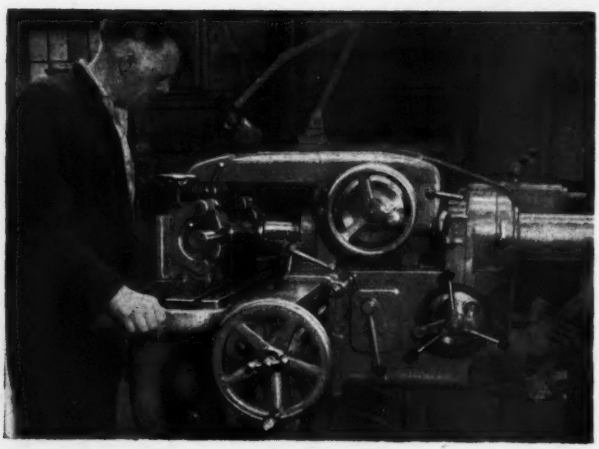


Fig. 9. Cutting the transverse slot for the driving cotter in a spindle for an Asquith type OD 1 radial drilling machine. The slot is 2¼ in. long by 0·650 in. wide, and is produced in 45 min. on this Forst type SFN keyseating machine. A hole is first machined in the En. 24 steel work-piece, with a drill, and the slot is then cut, using the spindle oscillatory motion, with a ½-in. diameter quick-spiral end mill, which is run at a speed of 190 r.p.m. Finally, a small chamfer is machined round the edge of the slot, on each side, with a rose-type countersinking cutter

Fig. 10. This machine was specially built by William Asquith, Ltd., for boring the arms of type OD 1, 3 PS, NLD and EGC radial drilling machines. The work is supported on a large fixture, which incorporates bearings for the boring bar. At the rear there is a standard boring machine bed unit, which carries an adapted Asquith NHB slide unit. The OD 1 arm seen on the machine is 3 ft. 6 in. long, and is bored 11⅝ in. diameter at one end, and 16½ in. diameter at the other, to limits of ±0·001 in., using carbide tipped tools. A feed rate of 0·008 in. per rev. and a speed of 38 r.p.m. are employed for finishing, and 0·015 to 0·020 in. of metal (on diameter) is removed

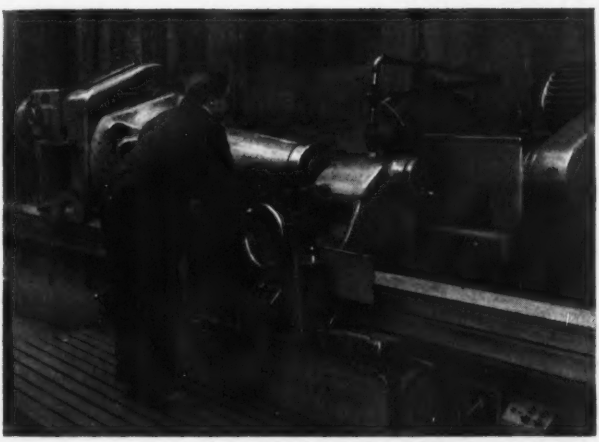


Fig. 11. Grinding equipment at the Asquith plant includes this machine from the Churchill type F range, which is equipped with a 30-in. diameter by 3-in. wide wheel, and will accept work up to 3 ft. 6 in. diameter by 30 ft. long. The machine is shown set up for grinding bearing surfaces on the column for an EGC girder drilling machine. The small end is finished to 12 in. diameter, −0·010, −0·015 in., and the large end to 21 in. diameter, +0·0055, +0·007 in., the work being run at 16 r.p.m., and traversed at the rate of 23 in. per min. This machine is also used for grinding spindles for 6- and 7-in. borers, long traverse screws, and columns for OD 1 and OD 4 machines

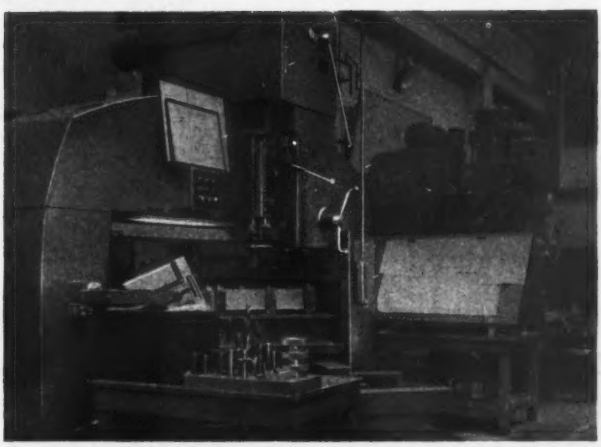


Fig. 12. Equipment in the toolroom of the Highroad Well works includes this Atlantic co-ordinate drilling and boring machine, with dial control for measuring to 0·0005 in. and repeatability to 0·0005 in. The machine has a table working area of 36 by 30 in., with traverses of 30 and 24 in. Spindle speeds are steplessly variable from 0 to 2,500 r.p.m., and the 9½-in. vertical traverse of the spindle is controlled by stops on an indexing drum. There is also provision for co-ordinate positioning under punched card control. In the background is seen an Asquith vertical drilling and boring machine with an OD 4 spindle head, and a 36- by 24-in. table

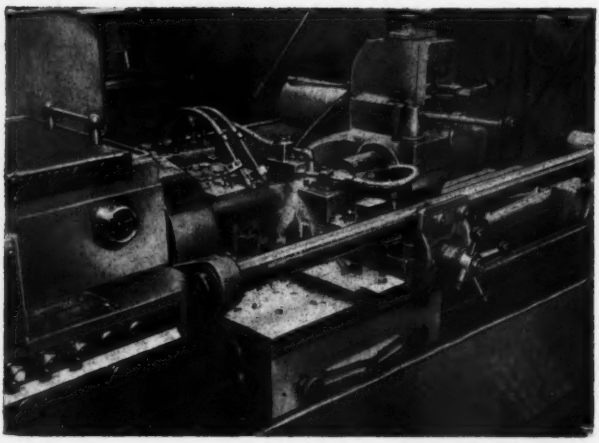


Fig. 13. Spindle racking shafts for Asquith OD 1 radial drilling machines are turned on this Drummond Maximinor multi-tool lathe, fitted with mechanical copying equipment. A Cutanit tool on the front slide is controlled by a template carried on a pivoting bar, and a facing tool is mounted on the rear slide. The En.24 steel billets are previously centre drilled, faced, and machined at one end. Rough turning is performed at a speed of 500 r.p.m. and a feed rate of 0·010 in. per rev., leaving $\frac{1}{16}$ in. of metal for removal during finishing. For this operation, the speed is increased to 600 r.p.m. and the feed to 0·020 in. per rev.

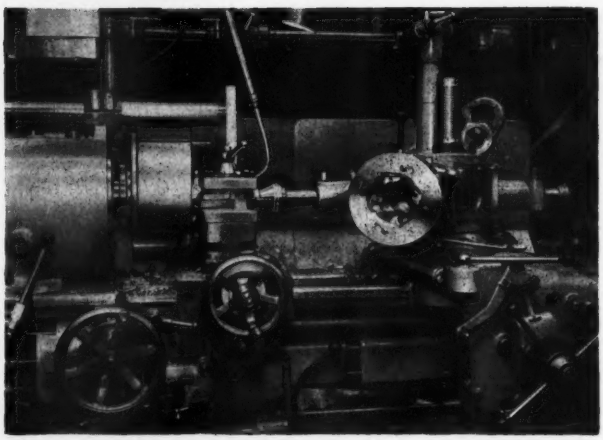


Fig. 14. Hollow jack screws for 7-in. and 8-in. ram borers are machined at this set-up on a Ward No. 10 combination turret lathe. A typical component is seen on the turret of the machine, and the 3½-in. 4 t.p.i. thread, of Whitworth form, is cut with a 4½-in. Coventry diehead. The free-cutting bright mild steel hexagon bar is drilled, bored 1½-in. diameter, and turned, before the thread is cut, at a speed of 8 r.p.m., with high-speed steel chasers. For certain threading operations, William Asquith employ a Fette thread-rolling head. This head is used on a Ward No. 8 turret lathe, for example, for rolling a 1¾-in. Whitworth thread

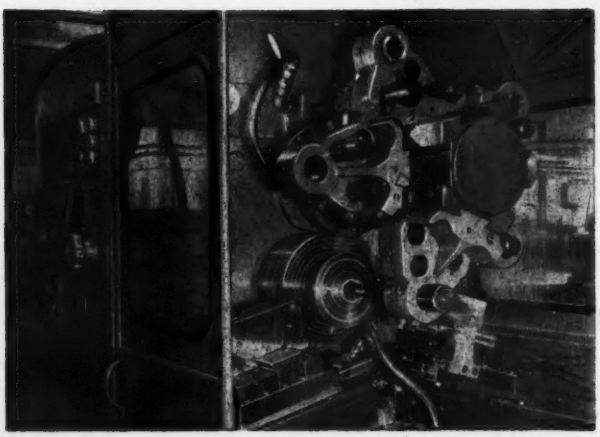


Fig. 15. Two Warner & Swasey-Asquith type 2AC chucking automatics are installed in the main machine shop of the Halifax works, one of which is here seen machining a feed gear blank for an OD1 radial drilling machine. At the first cycle of operations, the workpiece (in steel of 40-ton tensile strength) is rough turned and drilled from the turret, rough faced from the rear slide, and finished faced from the front slide. It is then reversed in the chuck, for the second sequence, which includes rough and finish turning the periphery to 7·400 in. diameter, +0, −0·005 in., and finish boring to 1·625 in. diameter, −0, +0·0005 in. The complete machining cycle occupies 10 min.

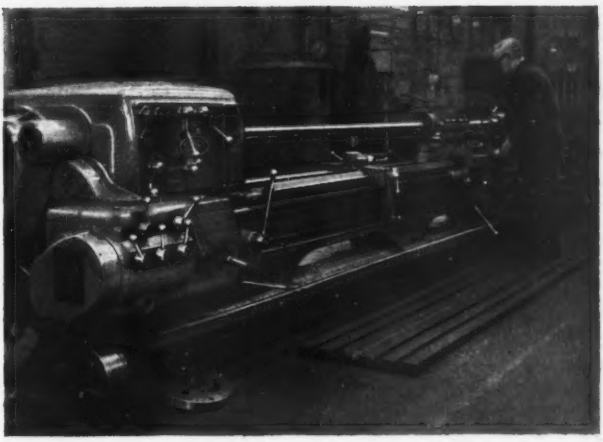


Fig. 16. Cutting a 3-t.p.i. 2¼-in. diameter, R.H. Acme thread on the bed traverse screw for an Asquith 7-ft. portable radial drilling machine, on a Swift 10V6 centre lathe. Made from steel of 45-50 tons tensile strength, the workpiece is 12 ft. 9 in. long overall, and the length of the threaded portion is 6 ft. 10 in. Two V-type supports and a travelling steady are used, and the thread is rough machined with a series of 0·010-in. deep cuts at a speed of 40 r.p.m. For finishing, the speed is reduced to 20 r.p.m., and 0·0015 in. of metal is removed from both thread flanks simultaneously, with a high-speed steel tool

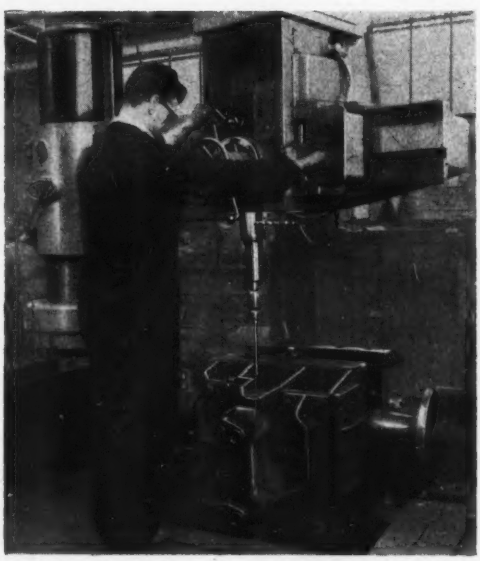


Fig. 17. Tapping operations on the saddle for an Asquith OD 1 radial drilling machine are performed on one of the company's 6-ft., type 3 PS radial machines. The workpiece is mounted in a double trunnion drilling jig, and at this set-up a total of 96 holes is drilled, also reamed or tapped, the sizes of the threaded holes ranging from ¼ to ½ in. diameter Whitworth. An Asquith No. 2 tapping chuck is fitted to the spindle of the type 3 PS drilling machine and facilitates the drilling, reaming and tapping of blind holes

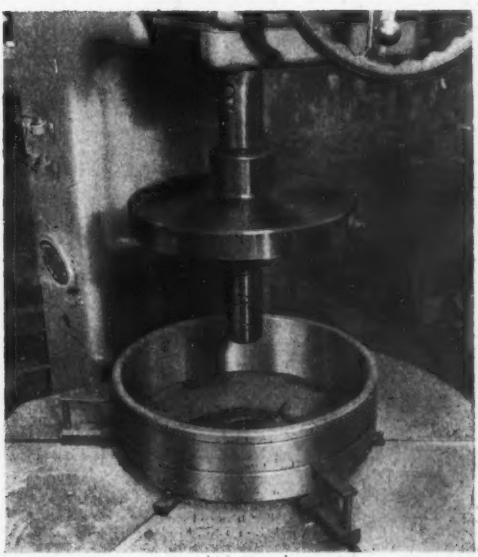


Fig. 18. Set-up for finishing the roller track for an Asquith Tru-Speed vertical drilling machine, to 17 in. diameter, −0, +0·001 in. The component is made from centrifugally cast iron and is 5 in. deep. A Microbore tool, with a tungsten carbide tip, is mounted in a steel disc on a bar which is held in the spindle of an Asquith No. 3 Tru-Speed vertical drilling machine. The bar is piloted in a bush in the machine table. For the finishing operation, a speed of 83 r.p.m. and a feed of 0·002 in. per rev. are employed

by the company was a simplified type of radial drilling machine for the production of holes in structural plates and girders, as an alternative to the then current practice of punching. Machines of this type found a ready sale among important constructional engineering firms, and it is of interest to note that, many years later, the company supplied all the drilling machines for use in the construction of the Sydney Harbour Bridge.

On the death of the founder in 1901, the business passed into the control of his son, the late Mr. J. H. S. Asquith, and nephew, the late Mr. J. W. S. Asquith, who decided that it would be advantageous if the efforts of the company were concentrated on the design and manufacture of radial, vertical and horizontal drilling machines, and heavy-duty horizontal boring and milling machines. Adopted in 1903, this policy has since been largely followed, although in the late 1920's, the company's range was widened to include special machines for use in the motor car industry, and a comprehensive series of machines has been established. The current range includes radial drilling machines from small sizes up to extra heavy duty types with arms of 12 ft. radius capable of drilling holes of 5 in. diameter from the solid; vertical drilling machines; portable universal radial drilling machines; and floor-type horizontal boring and milling machines, with spindles from 1½ to 11 in. diameter. Among the latter may be mentioned a ram-type machine, with electronic control of the spindle drive, horizontal feed, and vertical feed motors, which weighs more than 270 tons. A range of motorized, hydraulic and screw operated units, from which automatic and semi-automatic transfer and special machines can be built, has also been developed, and the construction of such machines forms an important part of the company's current activities. In addition, special light and heavy duty machines, some with tape control, are built.

Two sons of the late Mr. J. W. S. Asquith—Mr. Robert W. Asquith and Mr. Richard W. Asquith—are now on the board of William Asquith, Ltd. Mr. Robert W. Asquith, who is chairman of the company, is also chairman and managing director of the Asquith Machine Tool Corporation*, of which William Asquith, Ltd., is the largest member company. The Highroad Well works are claimed to be the most extensive—not only in this country but in the world—devoted exclusively to the production of drilling and boring machines, some indication of the facilities available being afforded by the accompanying illustrations. The site now extends to 12 acres, and the area of the factory and office buildings is some 200,000 sq. ft. A new heavy assembly bay was completed in March, 1960, and has an area of 30,000 sq. ft., a general view of this bay being given in the heading illustration. At the same time, two existing bays, parallel with the new bay, were extended to provide a further 30,000 sq. ft. of floor area. One of the extended bays provides for light and medium assembly work, and feeds the other bay, devoted to heavy assembly, also the new bay. Adequate provisions had to be made for handling the heavy components and sub-assemblies incorporated in the largest Asquith machines, and the assembly bays are well equipped with overhead traversing cranes. In the light-medium bay there is one 10-ton, and two 15-ton cranes; in the heavy bay one crane with hoists of 30 and 5 tons capacity, also two smaller units; and in the very heavy bay, three cranes, one with hoists of 75 and 10 tons, one with hoists of 50 and 10 tons, and one with a hoist of 25 tons capacity. A pit 140 ft. long by 44 ft. wide by 14 ft. deep is provided in the very heavy bay, and serves for the erection of the largest units, such as ram-type boring and milling machines, the maximum distance from the floor of the pit to the crane hook being 50 ft.

There are well-equipped machine shops at the Highroad Well works, and the main shop is arranged in three bays. In the central bay there are three overhead travelling cranes, each of 15 tons capacity, and smaller cranes are provided in the side bays, this equipment being supplemented with jib cranes and other lifting gear. Machine tools installed include a large battery of Ward capstan lathes, a Sentinel CriDan B threading lathe and a number of Swift lathes. One Swift machine is a type 24V7 admitting work 20 ft. long by 36 in. diameter, and there is also a type 12V5 lathe for work up to 30 ft. long by 17 in. diameter. The latter unit is employed for cutting the threads in elevating screws for 10-in. ram type boring machines, which are 26 ft. long by 5¼ in. diameter, with 2-start threads of 20 mm. pitch.

For heavy machining, there is a number of planers by Richards, Waldrich-Coburg, Butler, Stirk and Swift-Summerskill. The Richards planer is a large machine which will admit 14 ft. between the columns and the table has a stroke of 34 ft. Among the Butler planers is an openside machine with a table measuring 16 by 5 ft. A variety of boring machines is in use, including machines built by the company, also Kearns, Milnes, Richards and Ceruti. In the grinding section, Churchill and Precimax cylindrical machines are prominent, and

* The Asquith Machine Tool Corporation comprises William Asquith, Ltd., Kitchen & Wade, Ltd., Geo. Swift & Co., Ltd., Swift-Summerskill, Ltd., Drummond Brothers, Ltd., Ormerod Shapers, Ltd., Drummond-Asquith, Ltd., J. R. Woodvine & Son, Ltd., Modern Foundries, Ltd., and Asquith Electrics (Colne), Ltd. The corporation also has a 50 per cent. interest in Warner & Swasey-Asquith, Ltd.

Heald machines are used for internal work. There are extensive provisions for cutting gears and similar components, and among the machines for this purpose may be mentioned a type 19 and two type 5A Sunderland gear planers; a type 2A and a type 3A gear shaper; a Pfauter gear hobber; a Gleason bevel-gear generator; three Orcutt 24-in. gear grinders, and a 36-in. machine by the same maker for grinding gears and splines; a Barber-Colman and a Pfauter spline hobber; a Reinecker grinder admitting 6 ft. between centres; and two Craven machines, one for milling and the other for grinding worms.

The well-equipped toolroom has a self-contained jig boring section in which are installed a Newall, a Pratt & Whitney and two Société Genevoise machines. In addition, there is in the toolroom a specially designed and built Atlantic machine with electronic positioning arrangements for rapidly performing simple jig-boring operations.

There is no foundry at the Highroad Well site, and all castings are supplied by Modern Foundries, Ltd., Halifax, which is adjacent and is one of the companies in the Asquith group. This foundry has capacity for castings up to 45 tons, and has been extensively modernized.

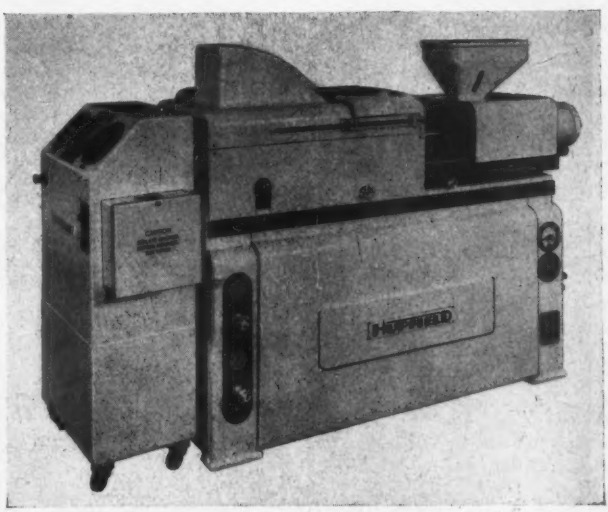
The total number of employees at the Highroad Well factory is now approximately 1,000, and about 10 per cent of this number are technical staff. There are 100 apprentices in training in the factory, and a special apprentice school was provided about 10 years ago. There are now 29 apprentices in the school, which has machining and fitting sections, each in charge of a full-time supervisor. Apprenticeship covers a period of five years, and there are craft, engineering and student grades. A craft apprentice spends one year in the school, three years in either the machining or fitting departments of the factory, and one year in the section in which he intends to specialize. On one day each week he attends the local technical school.

Glass Fibre Reinforced Resin Machine Components

In the accompanying illustration is shown a 2¼ oz. injection moulding machine made by Hupfield Bros., Ltd., Welsh Harp, Edgware Road, London, N.W.9, which incorporates a number of glass fibre reinforced polyester resin components supplied by Hedges Reinforced Plastics, Ltd., Dalston Gardens, Stanmore, Middlesex.

These components include the control cabinet, the hopper, the safety guards and all covers. In addition to the controls, the console on the left houses a 1½ h.p. motor, which is mounted on the inside of the front panel. The lower portion of this console forms a reservoir for 10 gal. of oil. A hopper, seen at the top right, which feeds the plastics material into the machine, has a smooth, gloss finish, both inside and out, and at the front there is a bonded-in Perspex window. For fastening the hopper in position, four stainless-steel threaded inserts are provided in the base. Another resin/glass fibre component is a sliding guard which incorporates a steel lug at each corner for attachment to the operating gear. Bonded into the top of this guard there is a panel of expanded metal to provide for ventilation and permit observation of the tool, also a raised hand grip. In all 20 glass fibre reinforced mouldings are employed on this machine.

The company states that mouldings are now being produced for customers in various fields from approximately 100 different moulds.



Hupfield 2¼-oz. injection moulding machine which incorporates 20 glass fibre reinforced mouldings supplied by Hedges Reinforced Plastics, Ltd.

L2

Delapena Automatic Machine for Honing Cylinder Barrels

AN AUTOMATIC HONING MACHINE, as shown in Fig. 1, has recently been supplied by Delapena & Son, Ltd., Tewkesbury Road, Cheltenham, Glos., to the Treviglio, Italy, works of Società Same, a large tractor-building company. It was designed to the customer's requirements, and is intended for honing the bores of individual cast iron cylinder barrels for air- and liquid-cooled diesel engines.

Two hydraulically-operated vertical honing units are mounted on a common base, which also supports a 4-station indexing table, with work-holding fixtures. Loading and unloading operations are performed at the two front stations, and although provision is made for the table to be indexed through an angle of 180 deg., to permit two fresh components to be honed during each working cycle, for the set-up shown it is arranged for 90-deg. indexing. Consequently, at the beginning of each cycle, a fresh part is moved into position beneath the right-hand honing unit, in readiness for a roughing operation, and the workpiece which occupied this station during the previous cycle is transferred to the adjacent station, for finish-honing by the other unit.

A close-up view of the working area is given in Fig. 2, and after the completion of the indexing movement, the component at each of the honing stations is raised by means of a hydraulic ram, and is thus clamped endwise against the under-side of a bridge member. When both the components have been clamped, the honing heads are lowered, through guide sleeves mounted on the bridge, and at the bottom of the pre-set stroke, the stones are expanded hydraulically and drive is engaged for honing. Each honing unit is controlled individually during the progress of the operation, and when the bore in the associated workpiece reaches the predetermined diameter, pressure on the stones is released, drive is disengaged, and the head is returned to the original position. The workpieces are held in the clamped positions until both the heads have been withdrawn, whereupon they are lowered to the table, which is then indexed in readiness for the next honing cycle. A fresh cycle is initiated only if a fresh workpiece has been loaded on to the table.

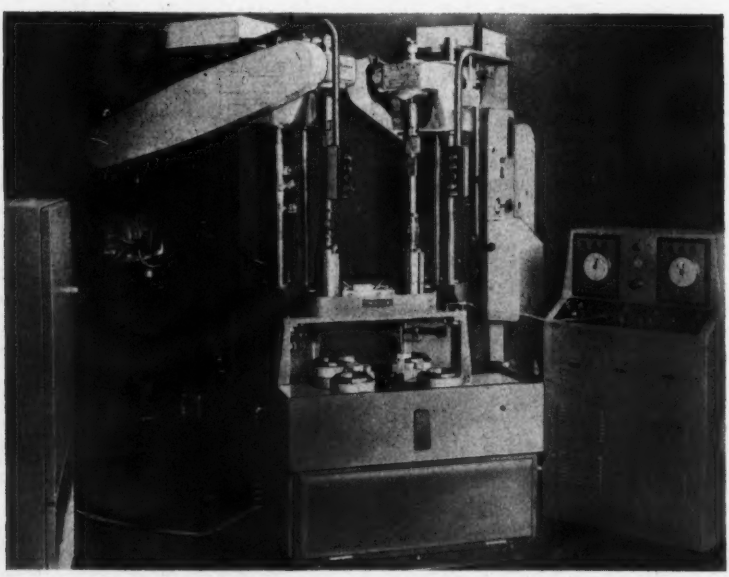


Fig. 1. Delapena twin-head automatic machine for honing the bores of individual cylinder barrels for diesel engines

The bore in each cylinder barrel has nominal finished dimensions of 4·5669 in. diameter by 9·84 in long. and prior to delivery to the honing machine, each barrel is fine bored 0·005 to 0·007 in. undersize. It is opened out to 0·0015 in. undersize during the roughing stage, for which diamond stones are used, and at the finishing operation, with silicon carbide stones, the diameter is held to limits of ±0·0005 in., roundness to ±0·00025 in., and surface finish to 6 to 8

micro-inches. The machine is arranged for operation on a 70-sec. cycle.

AUTOMATIC SIZE CONTROL SYSTEM

Developed in conjunction with Teddington Industrial Equipment, Ltd., Windmill Road, Sunbury-on-Thames, the independent air-operated automatic gauging system whereby each honing unit is controlled during the progress of an operation is of a design that was first demonstrated at the Olympia Machine Tool Exhibition last year, and incorporates a hardened gauging probe, which is carried on a bronze bearing at the top of the honing head. To prevent rotation, three lugs projecting from the probe are engaged with slots in the bore of the guide sleeve mounted on the bridge, when the head is lowered at the beginning of an operation. Compressed air is supplied to three radial nozzles in the probe by way of separate control equipment which incorporates two electro-pneumatic relays to provide for the operation of switches and indicator lamps.

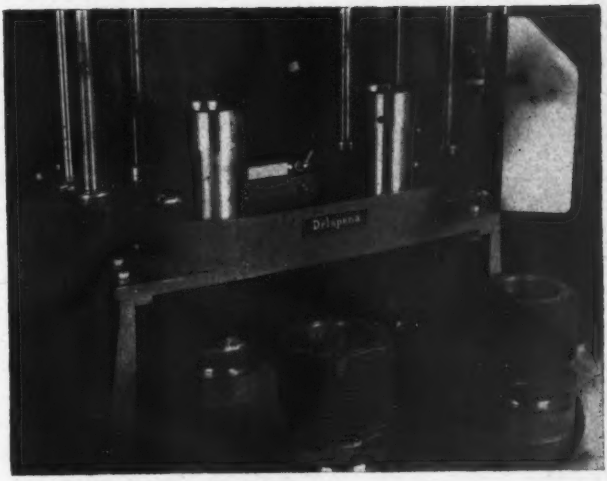


Fig. 2. Close-up view of the working area of the machine shown in Fig. 1

In operation, the gauging probe attempts to enter the bore being honed at the every downward stroke of the head, but is prevented until a diameter within approximately 0·004 in. of the required size is reached. When the size of the bore is such that entry of the probe is permitted, the resultant restriction of the escape of air from the nozzles causes an amber lamp to be illuminated, to indicate "undersize," and simultaneously, the control equipment is prepared for the subsequent reception of the "size" signal. On receipt of the latter, a green lamp is illuminated, and the honing cycle is stopped. It will be appreciated that during the initial stage of the cycle, when the probe is prevented from entering the bore, no restriction is imposed on the escape of air from the nozzles, and consequently a red lamp is illuminated which is intended for indicating "oversize."

To facilitate setting up and checking, there is a large dial, graduated in divisions of 0·00025 in. for a total range of 0·005 in., whereby the change of workpiece bore diameter is indicated continuously during the progress of honing. This dial is rendered inoperative by a switch when the machine is in normal use.

The equipment associated with the size control systems, together with electrical equipment for the machine, is mounted in the upper part of the floor-mounted cabinet seen at the right in Fig. 1. Operating controls are provided on panels at the top of this cabinet, and housed in the lower part there is a Keelavite hydraulic power unit, which incorporates a 1-h.p. motor-driven gear-type pump. From this unit, fluid is supplied at maximum pressures of 500 and 150 lb. per sq. in., by way of separate relief valves, to the workpiece clamping cylinders, which are controlled by a solenoid-operated valve, and to cylinders for indexing the table.

Coolant equipment is provided, and a floor-mounted cabinet, seen at the left of the machine, Fig. 1, houses a Philips Magna-Drum clarifier and a 30-gal. capacity tank. In the latter there is an immersed refrigerator evaporator coil, which is associated with a thermostatically-controlled system whereby the temperature of the fluid is maintained at 60 deg. F. From this tank, the fluid is delivered to the machine by means of a pump, and is discharged into the bores of the guide sleeves at the honing stations. After passing through the work bores, the fluid drains into a tank at the rear of the table, in which the heavier particles of swarf are allowed to settle. A separate pump mounted at the top of the tank, returns the coolant to the clarifying and refrigerating equipment.

HONING UNITS

The honing units are modified versions of the company's type VHM 3C machine, which is claimed to be particularly suitable for use with

automatic or semi-automatic set-ups. At the same time, the simplicity of the controls, and the rapidity with which tools can be changed on the standard type enable it to be employed economically for small-batch production. It has capacity for bores from 1 to 6 in. diameter, with lengths up to 24 in., and the throat depth is normally 9½ in. If required, a larger gearbox can be fitted, to increase the latter dimension to 14½ in. Steplessly-variable hone speeds from 50 to 400 r.p.m. and traversing rates from 0 to 10 in. per sec. are obtainable, and the stroke length can be varied up to 30 in.

Scale-models to Assist the Sale of Special Machine Tools

IN ORDER TO FACILITATE DISCUSSIONS in connection with the sale of their special unit-construction machine tools, Renault Machine Tools (U.K.), Ltd., Monkmoor Road, Shrewsbury, have had prepared a number of sets of scale models of their standardized machine tool elements. These models were supplied, to a scale of $\frac{1}{32}$ full size, by Visual Planning Systems, Ltd., Alperton, Wembley, Middlesex, and a typical set is seen in Fig. 1. It includes models of Renault unit heads of the various sizes available, column units, wing bases and indexing bases, also a length of conveyor track and a male figure, which gives an indication of size.

The machine models are finished in the standard Renault colours, and are housed in a carrying case with three sides rigidly fixed to the base and a hinged front wall and top. As may be seen, the interior of the case is painted to represent part of a workshop, and the front wall and top can be swung down to form an extension of the base. The floor members are ruled with intersecting lines to form squares, each with a side length (to scale) of 3 ft., and at the intersections of the lines there are holes to receive the location pegs that project from the bottom faces of the models.

Each model is provided with location pegs (in addition to that on the base) and drilled holes, so that the elements can be assembled to form machines of varying degrees of complexity, and Fig. 2 shows some assemblies that have been built with the elements seen in Fig. 1. The construction of the models is such that the machines can be readily broken down and re-assembled until an arrangement to suit the user's requirements is obtained. Since the models are cast in aluminium, the complete set and case weighs only a few pounds, and the case, when closed, measures 18 by 9 by 6 in.

Fig. 1. A typical set of scale models of standardized machine elements from the range built by Renault Machine Tools (U.K.), Ltd. The carrying case has a hinged front and top, and the inside is painted to represent a workshop interior

It has been found that the models give a much clearer impression of the manner in which machines can be built up from standard units than can be obtained solely from photographs and descriptive literature, although the latter are of complementary value. Although primarily intended to be used in discussions between the prospective user of a machine and the Renault sales staff, the models are frequently lent to production engineers to assist them to clarify their ideas, and for the investigation of machining

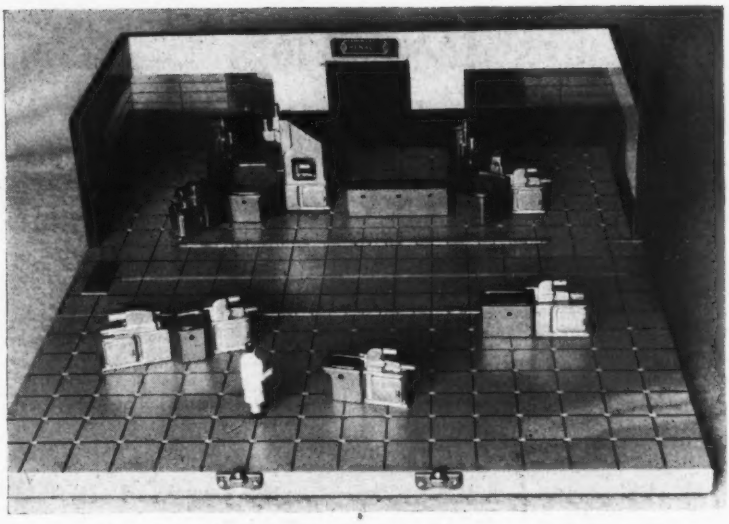


Fig. 2. Scale models of Renault standardized machine elements are here seen arranged to form models of machine tools of various types. These models have greatly facilitated pre-sales discussions

problems. It can also be demonstrated very clearly how a machine can be dismantled and the elements re-arranged should there be a change in the design of the product for which it was originally purchased.

Vision Stereoscope Projector

Developed by the Inspectorate of Armaments, the "Stereoscope" projector shown in the accompanying illustration has been added recently to the range made by Vision Engineering, Ltd., Send Road, Send, Woking, Surrey, and is claimed to provide a true stereoscopic image without the use of glasses by the operator. For a given magnification, it is stated, the field of view is larger than is obtained with a binocular microscope, and other advantages claimed include good depth of focus and the fact that viewing can be carried out in daylight. For viewing over long periods, the use of a projector eliminates eye fatigue, and the position of the operator's head is not critical.

The instrument is supplied with an objective giving a magnification of 7½×, which has a circular field of view of 1 in. diameter. Lamp units mounted at either side of this objective are inclined inwards, to illuminate the area under observation, and they are supplied with electrical current by a separate transformer unit. Two levels of lighting intensity can be selected by means of a switch on the transformer unit. Heat filters are incorporated, and the instrument is provided with tripod legs for bench mounting. If required, a hood can be supplied to shield the viewing screen. A wide range of additional equipment is being developed, and includes objectives to give magnifications of 15×, 30× and 50×, internal probe attachments, an arrangement for inverting the image, and a co-axial illuminating unit. Tripod legs of various lengths will be available, also brackets to permit mounting the instrument on a wall or a machine.

"Stereoscope" projector introduced by Vision Engineering, Ltd., Woking, Surrey

Scully-Jones Tool-holders

As mentioned recently in Machinery, B. O. Morris, Ltd., Morrisflex Works, Briton Road, Coventry, have been appointed sole licensees in the United Kingdom and the E.F.T.A. countries for the tool-holders, including quick-change, pre-set types, developed by Scully-Jones & Co., Chicago, Ill., U.S.A., and the production of certain widely-used items from the range is now being carried on in this country. It may be noted, moreover, that it is planned steadily to increase the variety of the British-made units.

The range includes holders for drills, reamers or taps, and quick-change collet chucks, and particular reference may be made to the series of Stub-A-Long collet chucks for use on multi-spindle drilling machines. With this chuck, the drill may be gripped by the flute lands, and by means of a screw at the rear end of a threaded bore in the body, it can be adjusted axially so that it projects by the minimum distance necessary. Torsional deflection under the cutting load can thus be kept to a minimum, to reduce chatter and improve tool life, and it is claimed that the support provided for the drill is such that the need for guide bushes is avoided.

A collet of the company's lock-and-eject type is employed, which is closed and opened by means of a nut that is mounted in ball bearings at the nose of the chuck. Chucks are available in seven sizes, to accommodate drills with maximum diameters from $\frac{1}{16}$ to 1¼ in., and they can be supplied for clamping in the spindle bores by radial screw, or for retention by the company's Quick-Ball-Lock collars. Mounted on the nose of the spindle, this collar incorporates spring-loaded cams, whereby a series of balls is thrust inwards to engage in an annular groove in the chuck. For removing the chuck, the cams are withdrawn by turning the collar through a small angle.

Also intended for use on multi-spindle drilling machines, the range of adjustable adapters comprises units with nominal diameters from ½ to 1⅝ in., and overall lengths from 3 to 5⅝ in., which are bored to take A.S.A. or Morse taper shanks from No. 0 to No. 4. With each adapter, the length by which the point of a drill, mounted in the body, extends beyond the spindle nose is pre-set by means of a Quick-Lock nut, on an Acme-threaded portion that extends from the outer end for a distance ranging from 1 $\frac{7}{16}$ to 2⅝ in., according to the size. After setting, this nut is locked by means of a radial screw, whereby a leaf—which is formed by an arcuate cut that extends into the bore—is thrust against the threads on the body, and with this arrangement, the need for a separate locking nut is avoided.

A slot provided in the body permits the use of a standard drift ejector, and there is also a slot for a Woodruff driving key. In addition, a flat is provided, against which a screw is clamped to secure the adapter in the spindle, and the flat is inclined, to ensure that the unit is clamped with the nut in contact with the spindle nose. Extension adapters of similar design are available with various shank diameters, and the body portions, which can be of reduced or enlarged diameter, may have lengths ranging up to 8 in., in 1-in. steps, for most sizes.

The Quick-Lock system is employed to facilitate setting a number of other units, and reference may be made to the range of drill holders, known as "drill stops," which incorporate adjustable depth stops. On each of these units, the stop sleeve surrounding the drill is attached to a knurled sleeve nut of Quick-Lock design, mounted on the threaded exterior of the body. The chamfered upper edge of this nut is graduated in divisions of 0·001 in., to enable settings to be made accurately, and to facilitate drill changing, the stop sleeve can readily be detached after the locking screw for the nut has been released. There are seven holders, to accommodate drills with maximum diameters from ¼ to 1½ in., and they have taper shanks and are bored to A.S.A. tapers from No. 2 to No. 4. The

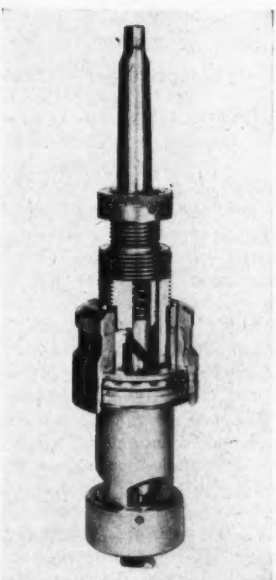


Fig. 1. Cut-away example from the Scully-Jones range of adjustable automatic recessing tools

maximum and minimum distances obtainable between the nose of the associated spindle and the end of the stop sleeve range from 3$\frac{1}{16}$ and 5$\frac{3}{4}$ in. up to 9 and 13$\frac{3}{16}$ in.

In Fig. 1 is seen an example from a range of automatic recessing tools cut away for purposes of illustration. This unit is equipped with a tubular spacer, surrounding the housing for the cutter spindle, and at the lower end is mounted a quickly-detachable stop collar. A spigot on the lower face of this collar is located in the drilled hole before cutting begins, for guiding purposes. If required, the sleeve can readily be removed and replaced by another collar, and the tool is then guided by passing the cylindrical spindle housing through a bush in the work-holding fixture. Adjustment of the axial position of the collar, and consequently of the distance between the recess and the upper face of the work, is made by means of a large-diameter threaded sleeve, the upper end of which is graduated, and a nut mounted on the shank of the tool provides for setting the radial depth of the recess. After they have been set, these members are locked by the Quick-Lock system.

Recessing tools of this type are available in four sizes, for cutting recesses in the walls of holes from $\frac{5}{8}$ to 1$\frac{1}{4}$ up to 1$\frac{1}{2}$ to 4$\frac{1}{2}$ in. diameter, to maximum depths ranging from 0·08 to 0·3 in. On the smallest and largest units, the stop collar can be adjusted through a total distance of $\frac{3}{4}$ in., a movement of 1$\frac{5}{16}$ in. being provided on the intermediate sizes, and the distance by which the body extends from the spindle nose of the machine ranges from 6$\frac{1}{2}$ to 13 in., according to the size. For use when there is limited space between the spindle and the work, an alternative tool, suitable for piloting in the work only, can be supplied in three sizes covering the same working range, and the body lengths are from 4$\frac{5}{16}$ to 6$\frac{5}{8}$ in.

A wide variety of tap holders is available, and attention is drawn to the type JT units, each of which provides for axial movement of the lock-and-eject collet chuck against pressure applied by a spring housed inside the threaded adapter shank. Units with compression and tension springs are available, to provide compensation for the use of feed rates which are greater or less than the pitch of the thread being tapped. There are seven sizes of each type, to accommodate taps ranging from $\frac{1}{4}$ to $\frac{3}{4}$ in., and the maximum travel of the chuck is from $\frac{3}{4}$ to 1$\frac{3}{4}$ in.

The Scully-Jones type JA floating holder incorporates a hollow cylindrical body, from which drive is transmitted to the tap spindle through sets of involute splines at opposite ends of a tubular coupling member. With this arrangement, the coupling member can take up various angular positions, to enable the tap spindle, which is supported by an annular rib located between two ball thrust bearings, to move radially to compensate for misalignment with the work. If desired, the unit can be supplied to provide for angular misalignment, and there is also a universal type. Five sizes, bored No. 1 to No. 5 A.S.A. or Morse taper, are available, with either taper or threaded adapter shanks.

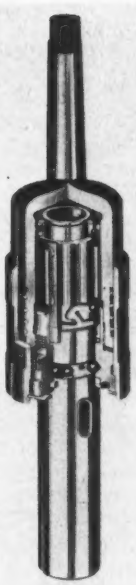


Fig. 2. With the Scully-Jones Safe-Torque tap-holder, a cut-away example of which is here shown, rollers are wedged against cam lobes on the spindle, to transmit drive, and pass over the crests when a pre-set torque is reached, to allow the arrangement to free-wheel

With the Safe-Torque tap holder, a cut-away example of which is shown in Fig. 2, drive is transmitted to the tap spindle through a series of rollers, which become wedged between the inner surface of the cylindrical body and lobes on a cam attached to the spindle. In operation, when the torque required to turn the tap increases due to the cutter reaching the bottom of a blind hole, for example, these rollers eventually pass over the crests of the lobes, and are then locked in positions between adjacent lobes, to permit the mechanism to free-wheel.

When the spindle drive is reversed, for withdrawing the tap, the locking system serves to re-set the mechanism, in readiness for the next operating cycle. For pre-setting the maximum torque to be transmitted, the cage in which the rollers are housed is moved axially, in relation to the tapered bore of the body, by means of a graduated, threaded collar. After it has been set, this collar is locked to the body by an internally-toothed, spring-loaded sliding sleeve.

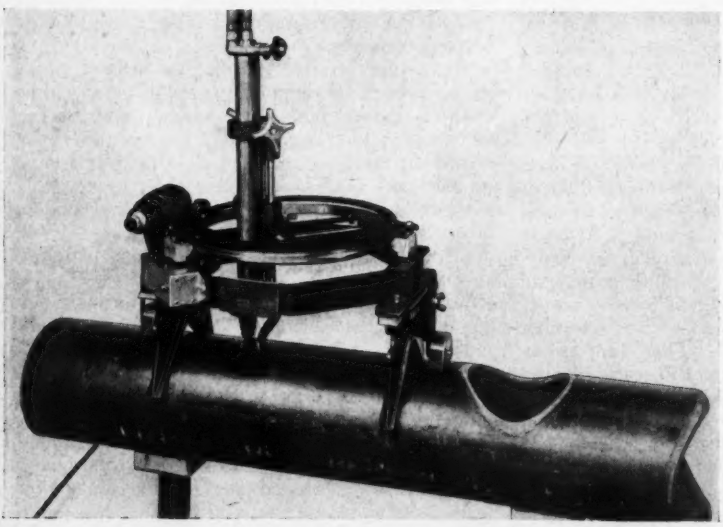
The tap spindle is taper bored, and the standard holder, which has a taper shank, is available in five

sizes, with torque ranges from 50 to 500 up to 1,000 to 2,400 lb.-in., for use with taps from No. 10 to 1½ in. Combined tension and compression axial-float types of three sizes can be supplied, for tapping threads from No. 10 to ⅝ in., and there are also three units with quick-change collet-type shanks, for use with taps from No. 10 to 1 in. A feature of the latter units is that the diameters and the overall lengths are considerably less than the corresponding dimensions of the other holders.

Steffan Universal Automatic Flame Cutter for Producing Holes in Pipes

The Steffan Manufacturing Co., U.S.A., have recently introduced the universal flame cutter here illustrated, for producing holes in pipes, the size of the pipe shown being 8 in. diameter. Cutting is performed by an oxy-acetylene torch which is traversed in a circular path by means of a variable-speed, geared electric motor. The torch is free to move vertically in its holder to follow the pipe contour, the movement being controlled by a roller which bears on the surface of the pipe.

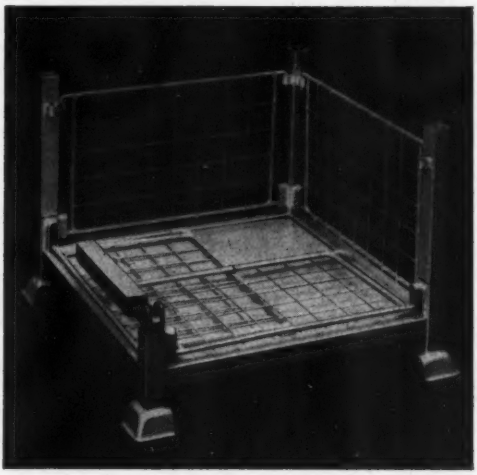
Radial adjustment is provided for the torch holder in its mounting, to suit the diameter of the hole required in the work. In addition, the ring assembly can be tilted to any angle up to 45 deg. to enable an elliptical hole with an angular edge to be produced, to accept a branch pipe at an angle.



Steffan universal automatic flame cutter for producing holes in pipes

Stephens Collapsible Transport Pallet

A standard form of collapsible post or box pallet, which is the subject of a patent application, has been introduced by E. Stephens & Son, Ltd., 58/66 Bath Street, London, E.C.1, and is shown in the figure. It can be supplied in any required size, and when in collapsed form has a height of only about 8 in., thus conforming to British Railways return travel requirements. These pallets can also be stacked with those supplied by other makers.



Stephens collapsible transport pallet

As may be seen in the illustration, the link joints which allow the permanently - attached posts to "collapse" are so designed that the posts require no form of bracing when erected. The posts may be round or square, and the detachable sides, which may be of mesh or sheet material, can be quickly removed from their retaining sockets.

Continuous Path Machine Tool Control*

A System Based on the Use of Coarse Optical Gratings

By B. J. DAVIES†

THE CONTINUOUS PATH control system that is here described was developed to enable a wide variety of workpieces to be made economically and reliably for a relatively small capital cost for equipment. A subsidiary object was to provide a system that only requires the minimum of attention from the machine operator.

A cutter centre path drawing of the workpiece is divided into programme steps comprising straight lines or circular arcs. This information is specified by simple rules on a planning sheet and is transcribed on to punched paper tape. The tape is fed into a small high-speed, special-purpose, digital computer, which specifies the co-ordinates of the required path at 10^{-4} in. intervals, on standard ¼-in. wide magnetic tape, and this magnetic tape is then employed in a small console containing 3-axis control and servo drive equipment, which is attached to the machine tool.

THE MEASURING SYSTEM

The measuring system is based on coarse optical gratings with less than 500 lines per inch, with which shuttering, rather than diffraction effects predominate. A long measuring grating, etched on reflective metal, is used in conjunction with a short, transmitting index grating, with lines of the same pitch. The index grating comprises four parts displaced in phase by a quarter of a grating pitch, and although the latter is typically 0·01 in., the measuring system interpolates to ±0·0002 in. A mark/space ratio of 1 : 1 is usually employed.

The arrangement of the optical system is shown diagrammatically in Fig. 1. A beam of collimated light *A* shines through the four parts of the index grating *B*, on to the measuring grating *C*, whence it is reflected back through the index grating on to the four photo-cells *D*, the currents from which are in a 4-phase spatial relationship. In this diagram, an indication of the intensity of the light reflected through the four parts of the index grating, for one particular relative position of the two gratings, is afforded by the shading.

PRINCIPLE OF OPERATION

The operation of the system may be described qualitatively by reference to the waveforms shown in Fig. 2, in which the first diagram in each of the series *a*, *b*, *c*, *d*, *e*, *f* and *g* corresponds to zero spatial phase shift between the index and reference gratings. As the index grating is moved with respect to the measuring grating, the resulting intensity of illumination on any one photo-cell varies approximately triangularly, as seen in the uppermost series of diagrams *a*.

It is first assumed that there is no relative movement between the index and measuring gratings, and in the first diagram *a*, the light intensity on the cells for the zero phase-shift condition is given by ordinates to the triangular waveform. The four resulting photo-cell currents which form a spatial

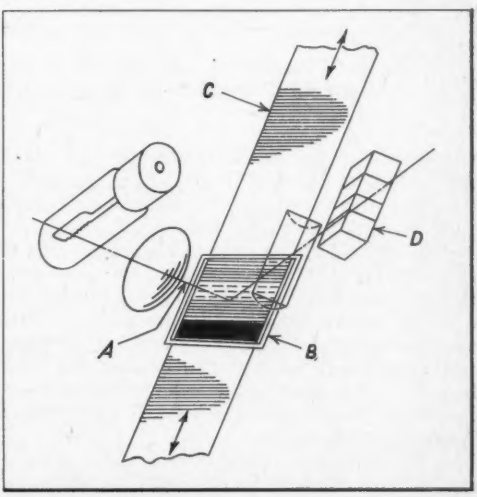


Fig. 1. Diagram showing the mechanical and optical arrangement of the reading head and gratings

* Abstract from a paper entitled "A Continuous Path Machine Tool Control System Using Coarse Optical Gratings," presented at the Second International Machine Tool Design and Research Conference, Manchester College of Science and Technology.

† The Staveley Research Department. See also MACHINERY, 98/1312—7/6/61.

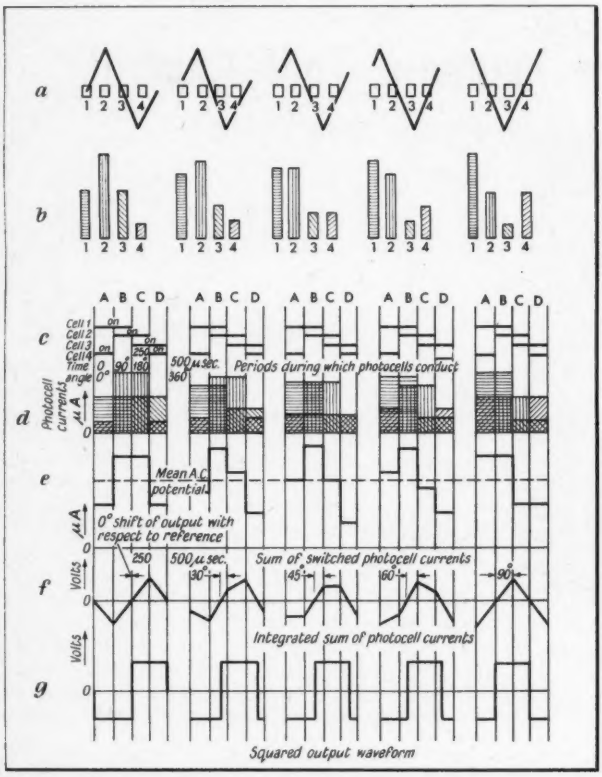


Fig. 2. Diagrammatic representation of wave-form "processing" stages in the measuring system

4-phase system, are indicated at *b*, and each photo-cell in turn is switched on by a 4-phase 250 c/s switching waveform, derived from the magnetic tape, as at *c*. Diagram *d* indicates the magnitude and duration of the currents in the four photo-cells and these currents are summed to produce a stepped waveform *e*, which has a periodic time equal to that of the switching waveform. After a.c. coupling, the resulting symmetrical a.c. signal is amplified and integrated to produce the wave-form seen at *f*, which is then squared, as at *g* by a circuit that triggers accurately when the waveform crosses the mean level.

In the remaining diagrams *a*, *b*, *c*, *d*, *e*, *f* and *g*, equivalent waveforms, for other relative positions of the index and measuring gratings, are illustrated. The time phase displacement between the square waveforms *g*, and a reference waveform such as the square wave used to switch photo-cell No. 3, is equal in magnitude to the spatial displacement between the index and measuring gratings. If f c/s is the switching frequency, v the relative velocity between the gratings in inches per sec., and s the grating cyclic length in inches, then, provided that $f > (v/s)$, the mean frequency of the output changes linearly with the rate of change of θ (the relative spatial phase shift between the index and measuring gratings) which is proportional to v.

In practice, errors are caused by departures from the ideal system, but under static conditions, tolerances on most of the variables are wide, and the contribution of the individual sources of error is readily kept below 1 per cent of the grating pitch. Moreover, the effects of several potential sources of error can be cancelled by a suitable setting-up technique. Experimental results indicated that, for a 54-in. grating with 100 lines per in., the interpolation error did not exceed $\pm 0{\cdot}0001$ in. and that the progressive error did not exceed $\pm 0{\cdot}00025$ in. Interpolation accuracies within ± 2 per cent can be achieved consistently.

The advantages of the system may be summarized as follows:—(*a*) adequate accuracy; (*b*) absence of moving parts; (*c*) optical and mechanical tolerances can be met by normal workshop practice; (*d*) ability to operate with a very wide range of grating pitches; and (*e*), the simplicity with which it may be incorporated in a continuous path control system.

CONTINUOUS PATH CONTROL SYSTEM

Fig. 3 is a block diagram of one axis of a 3-axis continuous path control system which incorporates the measuring system described. Apart from the motors, tachometers, measuring systems, limit switches, and control station fitted on the machine, all equipment is housed in a console measuring 24 in. by 18 in. by 36 in.

The input magnetic tape is run at 7½ in./sec., and has four tracks recorded as square waves, the tape being saturated positively and negatively, alternately. One track is the reference from which the measuring system reading head switching waveforms are derived. The other three control the *X*, *Y* and *Z* movements of the machine,

and are phase modulated square waves, similar to those produced by the measuring system. For example, the time phase of the X track is advanced one cycle in 1 sec., with respect to the reference track, if the table is to be moved in the $+X$ direction at a rate of one grating cycle per sec. (=0·01 in. per sec. for a 100-line per in. grating).

Since the X-, Y- and Z-axis circuits are identical, only the X-axis circuits will be described. The phase modulated flux square wave on the X track is read by the corresponding playback head E, and the resulting differentiated voltage waveform is amplified at F. By means of the reshaper G, the output from the amplifier is used to produce a waveform of the same shape as that recorded on the tape, and this reshaped waveform is the X-axis position command signal. The reference track 250 c/s square wave, of equal mark/space ratio, is processed in the same way (H, J, K) and 4-phase square waves are derived from this signal, by integration at L, which retards the phase by 90 deg., and by subsequent squaring, M.

To enable a datum to be established at any position within any grating cycle, the phase of the 4-phase switching waveforms must be adjustable with respect to the phase of the reference track. For this purpose, the 4-phase square waves are fed to four equally spaced tappings on a 360 deg. linear potentiometer N. The output of the slider of this potentiometer is a stepped waveform similar to that produced by the reading-head photo-cells, and is integrated and squared as in the reading head. The phase of the resulting square wave varies linearly as the potentiometer is rotated. From the resulting square wave, a 4-phase system of square waves is produced, to switch the X reading-head photo-cells at P. The output of the X reading head is the position feedback signal, and the X servo position error is obtained by comparing the phase of the command signal and the feedback signal in a "flip-flop" circuit Q. Here, as the phase of the feedback signal lags or leads the command phase, so the mean d.c. level of the output waveform becomes positive or negative.

Unless the feedback signal always follows the command signal to within $\pm$½ a grating pitch, which is equal to $\pm$0·005 in. for 100-line per in. gratings, the system can jump one or more complete grating pitches. To avoid this occurrence, the position error is prevented from exceeding $\pm$0·004 in. by a fault circuit R. This circuit detects the mean d.c. level of the servo position error signal, and shuts down the equipment when this error exceeds a voltage equivalent to $\pm$0·004 in. In this way, it is ensured that the system has inherent "fail-safe" characteristics of a high order, such that the work and machine are adequately protected against damage.

VELOCITY COMMAND SIGNAL

An X velocity command signal is produced at S by comparing the frequency of the X track with the reference track. Here, the X signals are fed into one monostable circuit that produces positive pulses, and the reference track signals into another monostable circuit that produces negative pulses of the same duration. These two sets of pulses are d.c. restored positively and negatively with respect to a d.c. reference potential, and the resulting d.c. level of the analogue sum of these two signals varies linearly in magnitude and sign, according to the variation in magnitude and sign of the X velocity.

The arrangement of the servo system is such that the X position error, velocity command, and velocity feedback signals from a tachometer T, are fed to transistorized servo amplifiers. Switched silicon rectifiers, which drive d.c. motors, are

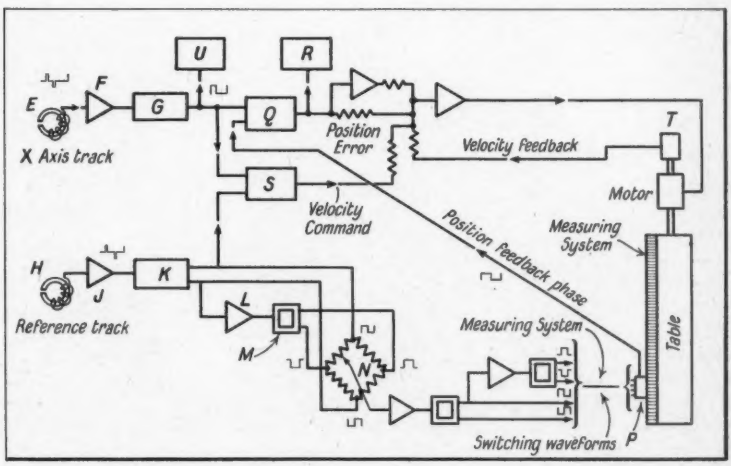


Fig. 3. Block diagram for one axis of a 3-axis continuous path control system

incorporated in the power stage. Alternative servo power stages, such as thyratron-driven and hydraulic motors, have been developed for different machine tools.

AUXILIARY FUNCTIONS

Provision is made for performing various auxiliary functions, by means of additional signals on the tape, which are recorded on the *X*, *Y* and Z tracks in the form of variations in the mark/space ratio. The mark/space ratios of these signals are detected at the output of the waveform reshapers by a circuit *U*, which operates relays accordingly. This circuit is similar to the fault detector *R*, and typical examples of auxiliary functions for which provision can thus be made include starting, stopping and reversing the spindle motor; changing tools; rotating the work; inserting stopping points which the operator can select, in the programme; and indicating programming steps. Cutter-radius compensation can also be provided as an optional extra, and for this purpose, a simple analogue circuit will be used.

Precautions that have been observed to ensure reliability of the equipment include the following: (*a*) as much data processing as possible has been removed from the shop floor; (*b*) the data processing circuits required on the work shop floor are simple because of the procedure of recording phase on magnetic tape, and producing phase in the measuring system; (*c*) transient interference does not affect performance, since no memory circuits, other than the fault "flip-flops", are used on the shop floor; (*d*) transient loss of signals for about 0·1 in. on the magnetic tape, due to damage or imperfections, does not produce permanent position errors. Consequently, the requirements for the tape and tape deck can be met with standard equipment. If the tape faults are of longer duration, the fault circuit shuts down the equipment automatically; and (*e*) monitoring of all important signals and supplies is incorporated, and since the equipment comprises simple replaceable transistorized units, servicing is facilitated.

Extensive development testing of the system has been carried out over a period of about 18 months. It has been used to machine complicated dies by contour milling, and steps have been taken to simplify the programming for die-making. It has also been used for the complete machining of gearbox castings, including the planetary milling of holes for ball races. In conclusion, it is emphasized that the control equipment cannot be considered without the machine tool, which must be specially designed for numerical control if the system performance is to be realized. Dimensional accuracy and rigidity of the structure, and a low-friction, zero backlash transmission, with high natural frequency, are required. Conventional manually-operated machine tools are often lacking in these respects, and for really satisfactory results, the control system, from data preparation to finished workpiece, must be designed as a whole.

The author acknowledges that this paper was presented by permission of Dr. E. H. Frost-Smith, Director of Research, Staveley Research Department.

ACKNOWLEDGMENT

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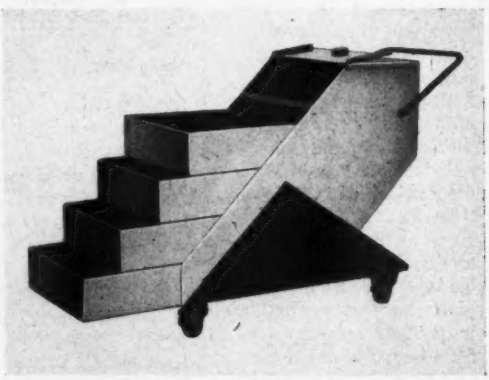
Pinder Toolkart Trolley

The Toolkart heavy-duty tool trolley shown in the accompanying figure has been introduced by W. Pinder & Son, Ltd., King Street, Peterborough. Constructed from heavy-gauge steel sheet, it is finished in stove enamel, and is fitted with roller bearing castors to enable it to be manoeuvred in confined working areas. The overall dimensions are 17 in. wide, 34¾ in. long, and 34½ in. high, and there are four tool trays which can be pulled out, as seen in the figure. There is also a compartment at the top, which is provided with a lock.



Pinder Toolkart heavy-duty tool trolley

Wheel Turning Lathe for Underground Rolling Stock

London Transport have recently brought into use at the Northfields depot an under-floor lathe, as shown in the accompanying illustrations, for machining the wheels of underground rolling stock without removing them from the cars.

Designed and built by the Scottish Machine Tool Corporation, Ltd., 17 Lynedoch Crescent, Glasgow, 3, to London Transport specification, this lathe incorporates a number of new features. It is the third under-floor wheel lathe that has been purchased by London Transport, the first—an experimental machine—having been installed at the Golders Green depot in 1947, and the second, at Neasden depot in 1956. These earlier lathes were intended for machining flanges only, whereas the new lathe can turn the complete profile of the wheel. The Neasden lathe, which was also supplied by the Scottish Machine Tool Corporation, Ltd., was described in MACHINERY, 857/89—12/10/56. Northfields is the main Picadilly Line depot and deals with "Tube-type" stock.

Owing to improvements in design and construction of the latest types of Underground rolling stock, the vehicle bodies are lifted from the bogies for maintenance purposes less frequently than was formerly necessary. Provision must be made, however, for the periodical machining of the wheels to restore the correct profile, and the under-floor lathes have enabled maintenance costs to be considerably reduced. In lathes of earlier design it was usual for the wheels to be rotated by drive rollers mounted on a horizontal axis parallel with that of the vehicle axle. The wheels rested on these rollers and the necessary adhesion was ensured by the weight of the vehicle itself, applied through the axle boxes. This dependence on adhesion limits the power that can be transmitted, and consequently depth of cut. On the new lathe, the drive is applied to the wheels by two pairs of rollers on vertical axes, which are pressed hydraulically against the inner and outer faces of each tyre. The two drive rollers exert balanced forces on each wheel, and no end thrust is applied to the axle. These rollers can be clearly seen in Fig. 1 and 2, and provision is made for stepless variation of the speed.

During the machining process, the weight on the axle is relieved by built-in hydraulic jacks which are applied to the under-sides of the axle-boxes, and concentricity is ensured by supporting the axle between rotating centres. These centres are carried in pivoted housings which can be swung clear manually, as seen in Fig. 2. In addition, they can be lowered by power, to positions clear of the rails when the car is to be moved over the machine.

The required profile is produced by a hydraulic

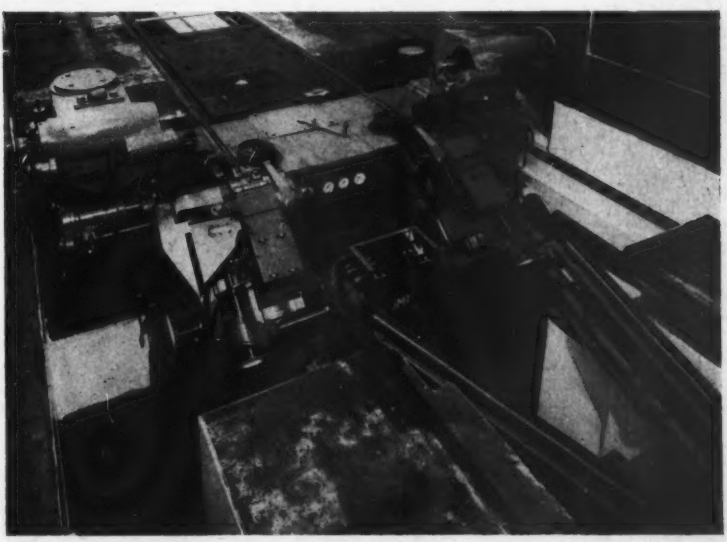


Fig. 1. Under-floor wheel lathe arranged for operation, with bridge rails swung back clear of the working area

copying system controlled by a template, and the tools employed have throw-away carbide tips and clamp-type chip-breakers. A close-up view of the lathe from the left-hand side, showing the tool in the operating position, is given in Fig. 3. Rapid power traverse is provided in both directions for the tool slides, and the feed rate is steplessly variable.

In operation, the axlebox covers are first removed together with any associated brake shoe gear. The car concerned, which normally forms part of a three- or four-car unit, and is not uncoupled for the purpose of machining the wheels, is drawn forward on to the lathe by means of a power winch until the appropriate axle is correctly positioned. Accurate location is facilitated by the provision of recesses in the railheads.

The pivoted tailstock housings are then swung into position and locked, and the entire centre units are raised by power, in unison, to a level slightly above the centre line of the axle. Next, the hydraulic jacks are engaged with the bottoms of the axle boxes so that the latter are raised to bring them into line with the rotating centres, which are then moved into engagement and locked. Swing rails, used to bridge the operating position while train movements take place, are then brought clear, as shown in Fig. 1, and the tool slides are traversed hydraulically to the operating positions, and locked. After the driving rollers have been applied hydraulically, the cutting cycle is performed under template control.

It may be noted that certain features of this lathe are patented.

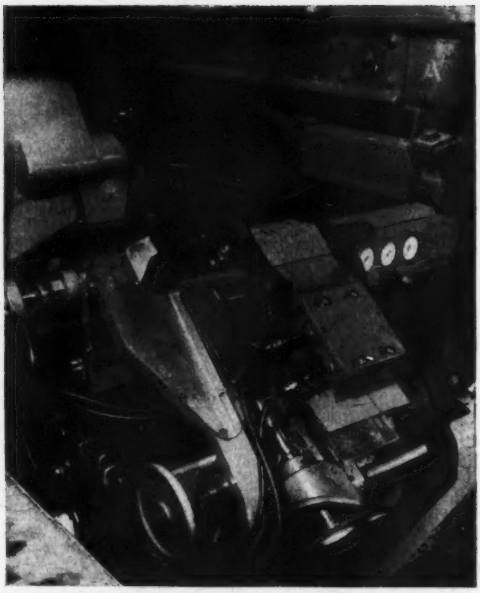


Fig. 3. Close-up view of the lathe from the left-hand side showing a tool in the operating position

Fig. 2. A view of the under-floor wheel lathe with the bridge rails in position, ready to receive a car

STEEL PRODUCTION during the first half of this year in the U.S.A. averaged 6,676,000 tons per month, as compared with an average of 7,387,000 for the full year 1960. For West Germany the corresponding figures were 2,823,000 and 2,796,000 tons; for Japan, 2,170,000 and 1,816,000; for the United Kingdom, 2,036,000 and 2,025,000 tons; and for France, 1,501,000 and 1,417,000 tons.

Operations on a Swift Copying Lathe with Re-circulating Ball Slideways

TO ENSURE THAT THE MAXIMUM advantage is derived from the inherent sensitivity of an electronic copying system, the large lathe shown in Fig. 1 is provided with re-circulating ball slideways for the movement of the saddle on the bed, and of the cross-slide on the saddle. Designed and built by Geo. Swift & Sons, Ltd., Halifax, the lathe is known as the type 24D, and it will accept work up to 12 ft. long between centres. It will swing 39 in. diameter over the cross-slide, and 50 in. diameter over the bed. Brief reference has already been made to this machine in MACHINERY, 97/287—3/8/60, when the arrangements for fitting the linear ball bearings [Dexter & Co. (High Wycombe), Ltd., Queen's Road, High Wycombe, Bucks.] were described.

The machine has now been in service for some time at the Finnieston Diesel Engine Works of Harland & Wolff, Ltd., Glasgow, where it is engaged, for example, in heavy profiling operations on piston and connecting rod components for the H & W/B & W 2-cycle, single-acting, opposed-piston, pressure induction engine. Fig. 2 is a close-up view from the rear of the machine showing the set-up for profile boring an exhaust piston crown. In the finished condition, the flanged portion of this component is approximately 29½ in. diameter and it is made from B.592:1950, grade A, cast steel. At the profile-boring operation, the inside of the piston is machined to match the periphery and to provide a wall-thickness of about 1¾ in. In the

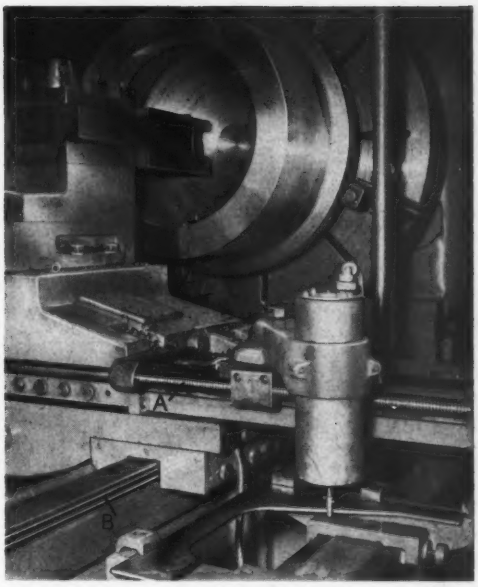


Fig. 2. Close-up view from the rear of the machine showing the set-up for profile boring a large exhaust piston crown. The Lancashire Dynamo copying head and associated template can be seen in the foreground

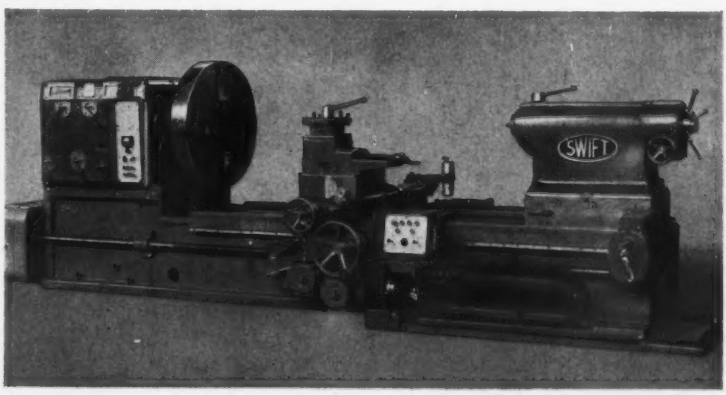


Fig. 1. This Swift 24D copying lathe is equipped with Dexter linear ball bearings for the saddle and cross-slide movements, and is installed at the Finnieston Diesel Engine Works of Harland & Wolff, Ltd., Glasgow

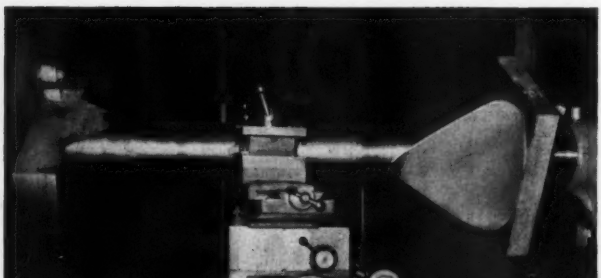


Fig. 3. Copy-turning the large and small ends of a forged steel connecting rod

crown area, the thickness is generally about 2½ in., but at the centre it is increased to 2¾ in.

For roughing, the work is run at 44 r.p.m., and a feed rate of 0·012 in. per rev. is applied, whereas for finishing the speed is increased to 101 r.p.m. and the feed rate is reduced to 0·006 in. per rev. It is particularly important that the radii at the intersections of the various shapes within the bore should blend smoothly, and that the surface finish should be fairly high. In the foreground in Fig. 2 can also be seen the template and the sensing head of the copying unit. The copying system is of the electronic type and was supplied by Lancashire Dynamo Electronic Products, Ltd., Rugeley, Staffs. Mounted with the sensing stylus projecting vertically downwards, the unit is supported from a bracket which extends from a special slide member attached to the rear face of the cross-slide. The screw *A* provides for adjusting the bracket transversely, for setting purposes and for applying a further increment of cut at the end of a copying pass.

In Fig. 2 can also be seen the precision ground cylindrical rods which form part of the Dexter linear bearing system for the rear bed slideway. Indicated at *B*, these rods are let into a channel which is machined in the bed, and it may be noted that the horizontal and vertical machined surfaces on the underside of the saddle are clear of those on the bed by approximately 0·005 in. Similar sets of cylindrical rods are let into another channel machined in the front of the bed, as may be seen in Fig. 1.

Fig. 3 shows the set-up for profile-turning the large and small ends of an En.4 forged steel connecting rod on the Swift lathe. The large blending radii at each end of the rod are machined with the copying attachment, using a sheet steel template similar to that seen in Fig. 2, and it is stated that the required accuracy and smoothness of blending are maintained in spite of the interrupted nature of the cut. For roughing, the rod is rotated at 52 r.p.m., with a feed rate of 0·010 in. per rev., and these values are changed to 126 r.p.m. and 0·006 in. per rev. for the finishing cuts.

The virtually friction-free characteristics of the Dexter bearings are stated to have enabled the high sensitivity of the Lancashire Dynamo copying system to be fully exploited, without any sacrifice in the rigidity of the machine. It is interesting to note that the movements of the saddle and cross-slide were, in practice, too "free," and that a simple braking system is incorporated whereby a very small amount of damping "drag" can be applied to these movements. A steel plate, mounted on edge, is secured to the bed and is engaged by a pincer-type friction brake. The grip can be finely adjusted, and applies a small amount of retardation. A similar arrangement is provided for the cross-slide.

MAXIMENT INDUSTRIAL FLOORING.—A new industrial flooring compound known as Maximent has been introduced by Burt Boulton & Haywood, Ltd., Surface Coatings Division, Crabtree Manorway, Belvedere, Kent. This material is noteworthy for its hardness and it is resistant to heavy impacts and abrasion, also to attack by oils, greases, and many corrosive chemicals.

Maximent is supplied as a liquid dressing of a creamy consistency, which is applied to a thickness of about $\frac{1}{16}$ in. by brushing or spreading on a prepared base that has been treated with a primer. A suitable foundation for the compound is a screed of sand and cement in the ratio of 3 to 1. Various grades of surface finish, ranging from a smooth gloss to a coarse non-slip floor can be obtained. A new 13,500-sq. ft. press shop in the West Country has recently been treated with Maximent compound.

G.W.B. Induction Heater for Billets*

G.W.B. Furnaces, Ltd., Dudley, Worcs., have recently supplied to the Austin Motor Co., Ltd., Longbridge, Nr. Birmingham, a two-tunnel type induction heating installation for billets, as seen in the accompanying Fig. 2. This installation is employed solely for heating En. 16 manganese-molybdenum steel billets measuring 1⅝ in. sq. by 8⅝ in., and 1½ in. sq. by 7⅞ in., which weigh approximately 6·5 lb. and 4·8 lb. respectively. Each billet is subsequently forged into two connecting rods on the Hasenclever press seen in Fig. 1.

The cropped billets are loaded manually, as seen in Fig. 2, on to a flighted conveyor which delivers them to the coil charging position about 8 ft. above ground level. Interlocked pushers are provided which are pneumatically operated on a pre-set time cycle, to load a billet into each of the two coils alternately, the discharge rate from each coil being one billet every 6·5 to 7 sec. The water-cooled coils are of high-conductivity copper, and each is 58-in. long. Electrically, the billet heater comprises two independent units and can be run as a single tunnel installation, if required. It will heat work to 1,250 deg. C.

* Abstracted from an article in the *Wild-Barfield Heat-treatment Journal*, Vol. VIII, No. 60, September, 1961.

Fig. 1. View of the G.W.B. billet heater from the delivery side, showing the Wilkins & Mitchell reducing rolls in the foreground on the left, and the Hasenclever press on the right

Power is supplied from two motor alternator sets each of 300 kW. output, at 500 volts and a frequency of 2,500 cycles per sec. A panel, which provides for independent operation of each set, houses the mechanical handling control equipment, the alternator regulators, and the automatic power factor control equipment. Automatic power factor correction is provided by switched capacitors mounted in the base of the furnace units, which

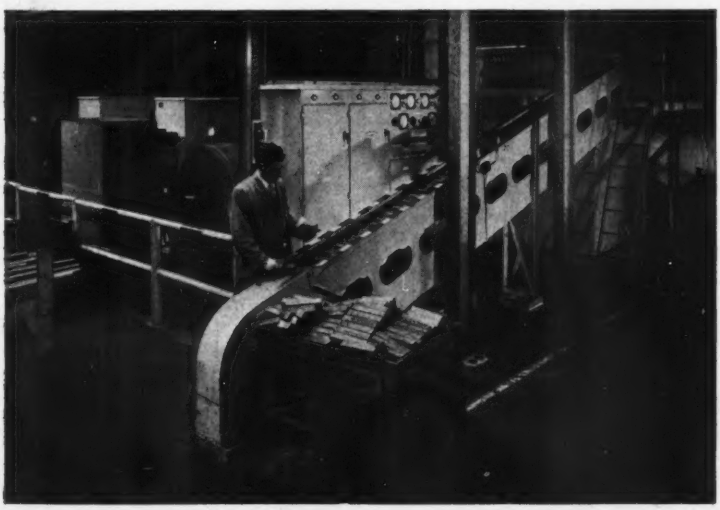


Fig. 2. The loading side of the G.W.B. billet heater at the works of the Austin Motor Co., Ltd., Longbridge

also houses the main isolating contactors and water-cooled matching transformers.

Fig. 1 is a view from the opposite side of the furnace to that seen in Fig. 2. The billets pass from right to left through the furnace, and after being heated, they are discharged through the apertures *A*, and pass down an inclined chute *B*, from which they are taken by the operator of a Wilkins & Mitchell reducing roll. After three passes through the rolls, the billets are fed by hand into the Hasenclever forging press (Paul Granby & Co., Ltd.) seen on the right. Here, flattening and rough- and finish-forging operations are performed, and the work is finally clipped in a Wilkins & Mitchell press.

This G.W.B. two-tunnel induction heating furnace has replaced three oil-fired furnaces and is stated to be capable of handling twice the amount of work. In addition, it takes up a relatively small amount of floor space and is stated to ensure clean and cool working conditions for the operators.

Lapmaster Lapping Machine Demonstration

Some of the flat lapping machines in the Lapmaster range were demonstrated recently at the works of Payne Products, International, Ltd., Buckingham Avenue, Trading Estate, Slough, Bucks. Lapmaster machines with 12-, 24-, 36- and 48-in. diameter laps are built in this country for Payne Products International, Ltd., and the company is the distributor for larger sizes, which are made in the U.S.A. In addition, precision lapping of customers' components on a contract basis, and the production of optical flats, is undertaken on a number of Lapmaster machines installed at the Slough works.

The American-built Lapmaster 72-in. machine shown in Fig. 1, which was demonstrated, is stated to be the largest of its type in Europe, and is suitable, for example, for lapping joint faces of die cast aluminium cylinder blocks and heads for motor car engines. There are four conditioning rings, which have an external diameter of 30 in., and a bore of 27½ in., and the radial distance between the bore and the periphery of the lapping plate is 27 in.

During the demonstration, two bell housings for motor car engines were mounted in a single carrier within one of the conditioning rings for lapping. If required, only one conditioning ring may be employed, and a workpiece which can be accommodated within a circle of 52 in. diameter can then be loaded at its centre, by a pivot on an arm attached to the top face of the base, for lapping. The lapping plate, which is driven by a 20 h.p. motor, runs at a speed of 42 r.p.m., and the work turns slowly about its centre. There is a ½-h.p. motor for driving the agitator for the lapping solution, which is delivered to the plate by gravity. The height of the top surface of the lapping plate above the shop floor is 34 in., and the machine occupies a space of 78 by 135 in.

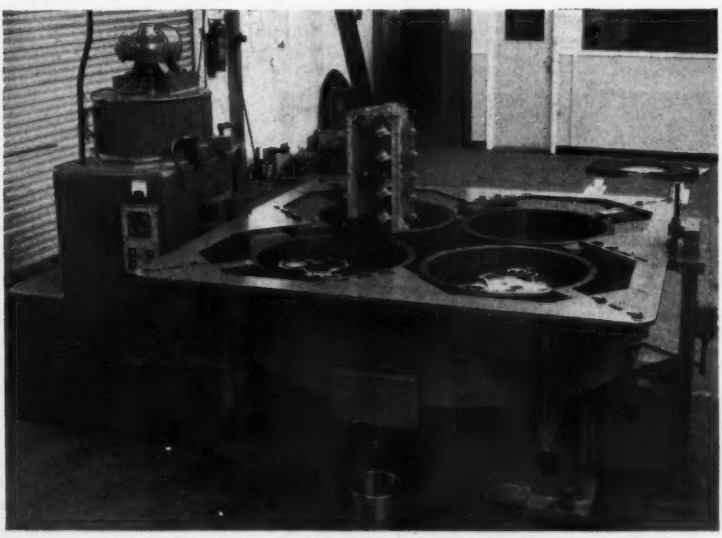


Fig. 1. Lapmaster 72-in. flat lapping machine

In Fig. 2 is shown the latest British-built Lapmaster 48-in. flat lapping machine, which incorporates a number of recent design improvements. The tank for the lapping compound, also

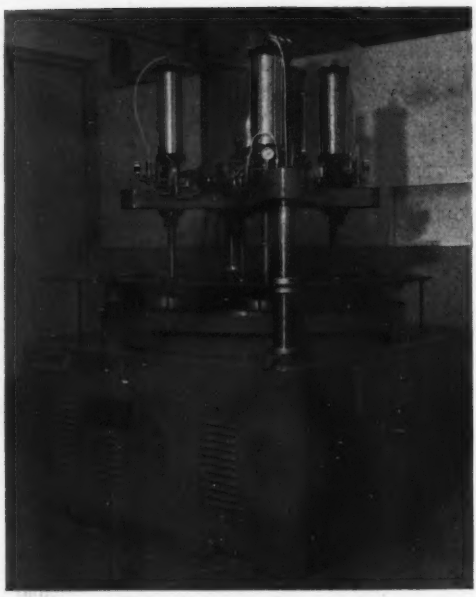


Fig. 2. The latest British-built Lapmaster 48-in. lapping machine. Air cylinders provide for applying pre-set loads to the workpieces, also for raising the pressure plates at the end of the cycle

the agitator and driving motor, are mounted on top of a cruciform arm above the lapping plate, which carries four air cylinders. These cylinders may be employed for applying pre-set loads to the workpieces while lapping is in progress, also for raising the pressure plates clear at the end of the working cycle, to facilitate loading and unloading. With the new arrangement, there are no projections at the sides of the base, so that access to all the conditioning rings can be readily gained for loading and unloading, and the machine occupies a floor space of only 63 by 54 in. Multiple feed pipes from the tank ensure that the supply of lapping compound is evenly distributed over the surface of the lapping plate. Four conditioning rings are provided, which have an external diameter of 20 in. and a bore of 17 in. When only one conditioning ring is employed, workpiece surfaces which can be accommodated within a circle of 36 in. diameter can be lapped.

The British-built Lapmaster 24-in. machine has recently been the subject of some design improvements, and a prototype of the latest version was available for inspection. Compound is delivered to the lapping plate on this machine by a diaphragm-type pump housed in the base, and it is stated that this arrangement ensures a uniform supply. A plastics-coated cast iron table surrounds the greater part of the lapping plate periphery, and since the top surfaces of the table and plate are in the same plane, workpieces may be readily transferred from one to the other. Roller brackets for locating the conditioning rings radially on the surface of the lapping plate, while the machine is in operation, can be adjusted simultaneously inwards and outwards by means of a handwheel, through an arrangement of links beneath the table, and a scale is provided to facilitate setting. With this arrangement, the conditioning rings can be readily positioned for accurately controlling the flatness of the lapping plate.

Refinements in Rotary Motions

(*Continued from page* 1179)

the member to which it is attached. As a result, relative angular movements occur between the mass and the housing and these movements are detected by an inductance system and can be recorded graphically. Similar equipment is also available for detecting fluctuations in linear motions.

It is possible to obtain records simultaneously of two rotary motions, two linear motions, or one rotary and one linear motion. Moreover, by passing the signals through an algebraic addition compensator, departures from uniformity of relative motion can also be determined and recorded. For testing a gear hobbing machine, one unit may be mounted on the hob spindle, and another on the table. It is also possible to carry out tests on single pairs of gears and on complete gear transmissions, for example in lathe headstocks, and if required, such tests can be made with the gearing under load.

It will be evident that with the facilities afforded by testing equipment of the types mentioned here, it should be possible to obtain substantial improvements in the accuracy of various types of machine tools, and consequently of the componets produced.

Atlantic Positioning Table

In MACHINERY 99/1168—15/11/61, reference was made to the Atlantic (Dowding & Doll, Ltd, 346 Kensington High Street, London, W.14), co-ordinate positioning table with Ferranti electronic equipment, and it was stated that a setting accuracy within 0·0005 in. was claimed. We are asked to point out that it is in fact claimed that settings can be made to ±0·00025 in.

NEWS OF THE INDUSTRY

East Yorkshire

CRODA, LTD., Cowick Hall, Snaith, Goole, inform us that their Gelanol rust preventive has been very well received, particularly by the engineering trades. Another product known as Aquamove B combines the properties of a rust preventive and a de-watering agent. The compound contains a spreading ingredient which enables it to be applied evenly, and takes up water from any surface, leaving behind a rust preventive film after solvent evaporation. This film has a life of several months under good storage conditions, and as it possesses lubricating properties, it need not be removed before using the treated workpiece.

Crocell hot dip strippable coating is in demand by engineers for the protection during storage of such article as cutters and gauges. The material is transparent, so that names or numbers on a treated component can be easily read. Soluble oil coolant made by the company under the name of "Staycool" is now well established. It was developed originally at the request of one of the large steel companies, and was placed on the market about a year ago, for use in most machining operations as well as in rolling.

JOHN CHERRY & SONS, Beckside, Beverley, have a very full order book, and report that all departments are busy. Pumps made by the firm are in use in various countries throughout the world and many of the current orders are for export.

THE HUMBER OIL CO., LTD., Marfleet, Hull, continue to experience a heavy demand for Humbrol products, and those in their range of particular interest to the engineering trades include the Hi-Glow fluorescent paint (used mainly for indicating danger areas), white line floor paint, and quick-drying enamel. The last named is proving very popular for the re-painting of machinery since the equipment need only be out of service for a few hours. The company also produces a 10 per cent sulphurized cutting oil, for which there is a steady call.

J. H. FENNER & CO., LTD., Marfleet, Hull, have a very full manufacturing programme covering the whole range of their products, and report, in particular, that the Spacesaver wedge belt drives introduced in 1960 have become well established. To meet the growing demand for the company's products in overseas markets four manufacturing plants are now in operation outside this country—two in India, and the others in South Africa and Australia. This year is the company's centenary, and the new Hainsworth Research Centre will be opened

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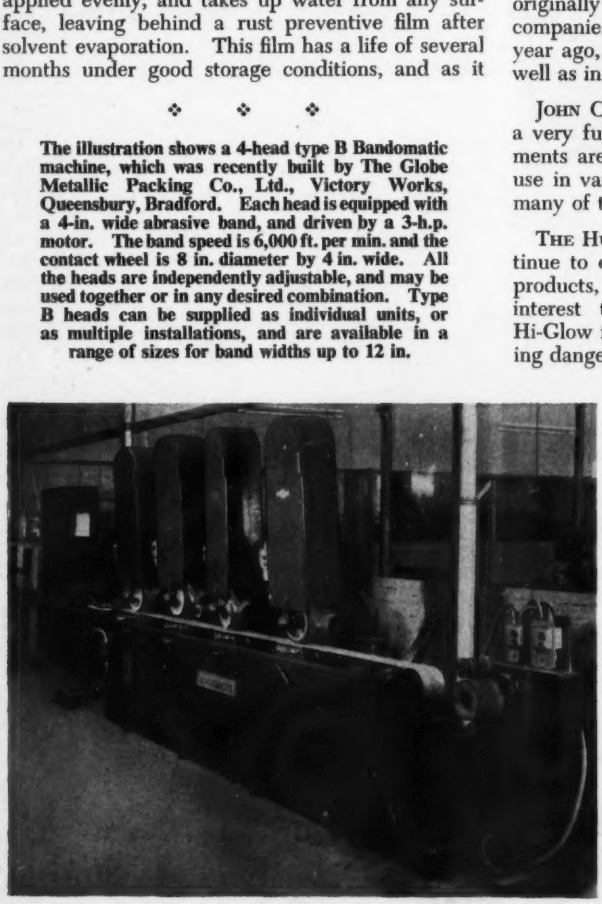


The illustration shows a 4-head type B Bandomatic machine, which was recently built by The Globe Metallic Packing Co., Ltd., Victory Works, Queensbury, Bradford. Each head is equipped with a 4-in. wide abrasive band, and driven by a 3-h.p. motor. The band speed is 6,000 ft. per min. and the contact wheel is 8 in. diameter by 4 in. wide. All the heads are independently adjustable, and may be used together or in any desired combination. Type B heads can be supplied as individual units, or as multiple installations, and are available in a range of sizes for band widths up to 12 in.

on December 15 by the Rt. Hon. Lord Robens of Woldingham, P.C. The premises which will then be vacated by the research staff will be used for production.

MANUFACTURERS EQUIPMENT CO., LTD., Sutton Road, Hull, are makers of conveying equipment, and can supply a range of standard units which can be ordered individually or as part of a complete layout designed to suit particular requirements. One such scheme was recently completed for Westclox, Ltd., at their Dumbarton factory, and provides for "first in, first out" live storage. Sound and colour films of this scheme are available on application to the company. Great interest is being shown in the recently introduced switching units which enable goods passing along a feeding conveyor to be directed at will to right or left on to other conveyors. Another design also allows the goods to pass straight through the unit without being diverted to either side. These units will operate in reverse and enable any one of two (or three) conveyors to feed a single track.

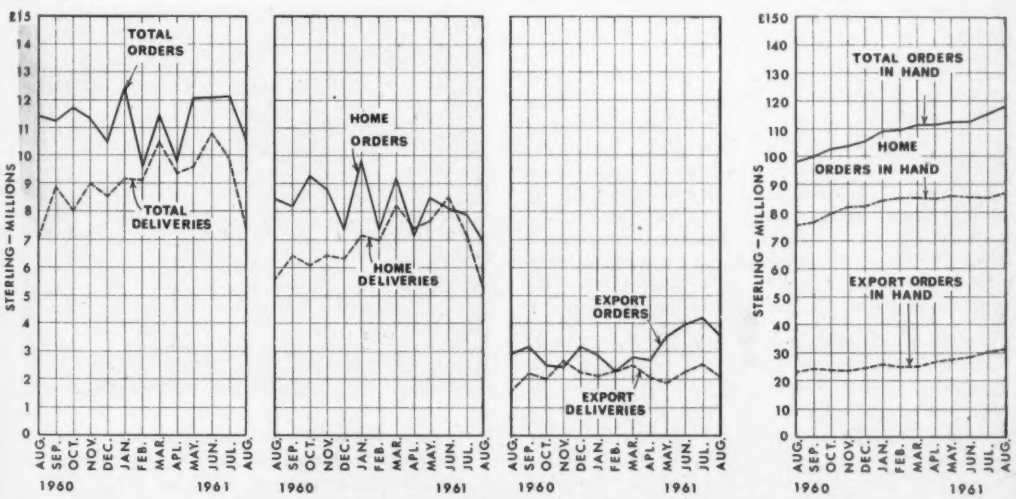
Among units at present in progress in the works, some are destined for export to Italy, and enquiries are in hand from many overseas countries as well as from the home market. Some schemes now in progress will include the company's A.P.C. conveyors which permit goods being transported to be brought to rest by finger-tip pressure whilst the conveyor is still being driven. When the obstruction is removed, spacing between items is obtained automatically.

ADAMS HYDRAULICS, LTD., Peaseholme Green, York, are very busy with the production of sewage disposal plant. Orders in hand include many for export, and for use on large ocean-going liners. In accordance with the policy of keeping the machine shop as up to date as possible, the company recently installed a Dean, Smith & Grace 30-in. by 144-in. lathe, and several other machines of various types are to be ordered.

ARMSTRONG PATENTS CO., LTD., Eastgate, Beverley, are experiencing a continued heavy demand for their products which include hydraulic shock absorbers mainly for the motor car industry, closed circuit hydraulic actuators, and the Heli-Coil range of screw inserts. A new extension for the production of these inserts is now in full operation and is equipped with automatic plant. Additional office accommodation is being added, and it is hoped that it will be ready for occupation shortly.

MACFARLANE THIRSK (ENGINEERS), LTD., Swine Gate, Hessle, who undertake the production of small turned parts and second operation work, report that there is a steady demand for their services. We noted during a tour of the works that the company has adapted various standard machines in order to obtain reductions in operation times, and one such adaptation will be described in a forthcoming issue of MACHINERY.

BOOTHAM ENGINEERS, LTD., Bootham Row, York, are experiencing heavy calls in connection with



The above graph shows the values of machine tool orders and deliveries for the twelve months ended August 1961 also the values of orders in hand

the various services which they offer to engineers, including repetition welding, general light machining, chain repair and testing, and metal spraying, also the repair and overhaul of engines and diesel fuel pumps for motor vehicles. The latest addition to the equipment in the machine shop is a Mitchell 8½-in. lathe with 8-ft. bed. The company has long been restricted for space, but it is hoped that arrangements will shortly be made which will permit expansion.

J. J. MARKLEW.

London and the South

SELSON MACHINE TOOL CO., LTD., Sunbeam Road, N.W.10, inform us that they are experiencing a steady call for a variety of machine tools. Orders have recently been obtained for a piston balancing machine by Morris Machine Tool Co., Cincinnati, Ohio, U.S.A., and a 8-in. ram-type horizontal boring machine by Skoda, Czechoslovakia. A new office building on three floors, constructed during the past year, is now in use.

MORTIMER MACHINE TOOL CO., LTD., Mortimer House, Acton Lane, N.W.10, are enlarging their warehouse and showroom to provide improved storage and display facilities. Continued interest is reported in Köping V.F.20 and U.F.10 milling machines. The latter are available in universal, plain, vertical, automatic cycle, and automatic cycle programme-controlled forms, and may be provided with 8-h.p. or 5-h.p. main motors. Other agencies held by this firm include those for Fromag key-seating machines and Svend Jakobsens hydraulic surface grinding machines.

B. ELLIOTT (MACHINERY), LTD., Victoria Works, Willesden, N.W.10, have a good order book for a wide variety of machine tools including centre lathes, milling machines, grinding machines, shaping machines, and hacksawing machines. Cardiff sliding, surfacing, and screw-cutting lathes, built in the company's works in South Wales, are available in 18 versions with centre heights of 7½ in., 8½ in., 9 in., and 11 in. Victoria milling machines can be supplied in various forms and some are arranged for automatic cycle operation.

NICKOLS AUTOMATICS, LTD., Olds Building, Windsor Road, Slough, Bucks., who were formerly at Carlisle Road, London, N.W.9, have greatly increased their facilities for the production of equipment for the conversion of capstan lathes to automatic sequence control. Among the interesting conversions now available is one for the Herbert Flashcap lathe, fitted with an indexing Quadra-chuck, to enable multiple-end components, such as 4-way connections and T-pieces, to be machined automatically.

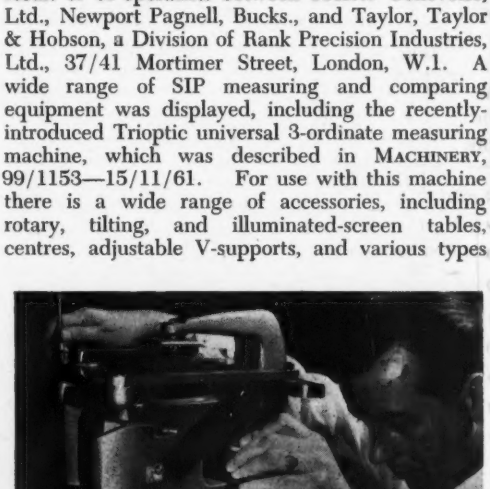
For some time the company has been converting Ward 2A and 3A capstan lathes to automatic operation either at their own or customers' premises. The range of standard machine tools for which such conversion equipment may be provided is being gradually extended.

SURPLICE & TOZER ENGINEERING CO., LTD., Acre Works, Windsor, Berks., a member company of the Metropole Group, are as busy as ever with orders for precision parts and assemblies, also metal spinnings in the small to medium diameter range.

F. W. HERRIDGE.

SIP/Taylor Hobson Exhibition

An exhibition of precision measuring equipment and machine tools was held recently at the Mayfairia Rooms, Bryanston Street, London, W.1, as a result of co-operation between Société Genevoise, Ltd., Newport Pagnell, Bucks., and Taylor, Taylor & Hobson, a Division of Rank Precision Industries, Ltd., 37/41 Mortimer Street, London, W.1. A wide range of SIP measuring and comparing equipment was displayed, including the recently-introduced Trioptic universal 3-ordinate measuring machine, which was described in MACHINERY, 99/1153—15/11/61. For use with this machine there is a wide range of accessories, including rotary, tilting, and illuminated-screen tables, centres, adjustable V-supports, and various types



Close-up view of the new pen unit which has been introduced by Taylor, Taylor & Hobson for use on their range of engraving machines. Scales can be drawn from templates, or by picking-up and inking over markings sketched on a blank

of microscopes. Demonstrations on this machine were concerned, for instance, with the checking of a large-diameter internal taper thread for accuracy of pitch, taper, and helix angle.

Among the exhibits of Taylor, Taylor & Hobson was a new type of mechanical pen for marking scales, for example, and a close-up view of the unit in use on a type D engraving machine is shown in the figure. The pen assembly incorporates a quill mounted within a plunger unit, the weight of which is counterbalanced by a coil spring. A range of interchangeable pens is available, and they are located in a special guide, which ensures repeatability for position within 0·001 in.

The pen assembly is mounted on the engraving machine in place of the usual cutter, and is brought down to a dead stop either by a lever or a screw feed control. It can be used in conjunction with a master copy of the scale to be drawn, as with engraving practice, or for picking-up and inking-over markings previously sketched on a blank.

Other items shown by Taylor, Taylor & Hobson included: Talymike auto-sizing equipment for use on cylindrical grinders; various new accessories for Talysurf equipment; the Talylin instrument, which has a travelling pick-up and provides for checking form errors over distances up to 4 in., with reference to a glass datum straight-edge incorporated in the unit; and a prototype engraving machine of increased capacity and improved rigidity. This machine will cover an area of 13 by 13 in., and the pantograph and engraving head are of the ram type, being carried in guides on top of the column. With this arrangement, the head can be adjusted to provide various distances between the cutter spindle and the column. The machine incorporates an improved pantograph system, and it is hoped to describe it more fully in a forthcoming issue of MACHINERY.

King Material Handling Film

"The Way of Kings," is the title of a new 16-mm. film which was recently shown at the British Council Film Theatre, Hanover Street, London, W.1, by George W. King, Ltd., Stevenage, Herts., who specialize in the design and production of materials handling equipment.

The opening section of the film is devoted to conveyor systems which are installed at the new plating plant of Vauxhall Motors, Ltd., Luton, and attention is drawn to the patented Stanrun twin-rail overhead conveyor whereby some 50 different types of parts are carried from the store and are automatically passed through the various stations of the plating plant.

Sequences are then included of King mechanical handling units at the works of F. Perkins, Ltd., Peterborough. A Marvex electric chain hoist is employed to carry cylinder blocks to an assembly conveyor of the slat type. After it has been unloaded, the empty hoist automatically returns to the opposite end of the runway to receive the next block. Assembled engines are transferred to a Dual-Duty overhead chain conveyor and are carried to the test shop where they are retained in "waiting lines" until vacancies occur on the test beds. Engines are then directed to the appropriate positions and after they have been tested are returned to the main conveyor whereby they are carried to an Under-Tug floor conveyor. The latter serves the auxiliaries department where dynamos, and starter motors, for example, are fitted. Next, the engines are moved by a Super-Track overhead runway to the paint shop.

The last section of the film is concerned with an egg packing station at Kenninghall, where some 3,000,000 eggs are handled per week.

With a running time of 22 min., the film is available free on loan on application to the publicity manager of the company. Although primarily intended for sales-promotion, it serves to draw attention to the extent of the development in mechanical handling equipment, which has taken place during the past few years.

Screw Manufacturers' Association

The annual general meeting and luncheon of the Screw Manufacturers' Association was recently held at the Trocadero Restaurant, London, when certificates were presented to the apprentices of the member firms by Commander Sir Peter Agnew, Bt., M.P. Recipients of the awards were as follows:

APPRENTICE COMPLETION CERTIFICATES: M. J. Green, R. A. W. Bridger, and R. L. Barker, of Acton Bolt, Ltd.; D. H. Spalding, D. A. Hedge, P. R. Craven, and John Bell, of Anglo-Swiss Screw Co., Ltd.; M. T. S. Cruikshanks, of John Bradley & Co., Ltd.; C. J. Breakspear, S. Morgan, D. J. Knight, G. P. Sellears, G. H. Cameron, F. Dulieu, A. D. Evans, R. A. Sharp, and A. R. Comber, of Davis & Timmins, Ltd.; Francis Farmer, Michael Clarke and Keith Bonney, of Linread, Ltd.; and Brian Millington, of Ephraim Phillips, Ltd.

CERTIFICATES OF MERIT: A. R. Bradshaw, P. A. Baker, R. L. Barker, and R. W. Banner, of Acton Bolt, Ltd.; N. Runciman, of Anglo-Swiss Screw Co., Ltd.; S. Morgan, D. J. Watts, and J. A. Weeks, of Davis & Timmins, Ltd.; R. F. Hewitt and E. Hamilton, of Datim Machine Tool Co., Ltd.; Raymond S. Wilson, Michael Bradshaw, and Terence Devey, of Linread, Ltd.; R. W. Hill and F. A. Yates, of L. H. Newton & Co., Ltd.; and B. L. Scarfe, F. E. Mott, and A. M. King, of Ross, Courtney & Co., Ltd.

Sir Peter Agnew afterwards spoke about the origin of the Common Market, its organization, and its advantages and drawbacks.

Trade Publications

ELCONTROL, LTD., Wilbury Way, Hitchin, Herts. Data sheet describing the recently introduced types UVI and UV2 ultra-violet flame detection heads which offer the advantage of better discrimination in certain applications.

ZINC ALLOY DIE CASTERS ASSOCIATION, 34 Berkeley Square, London, W.1. The Autumn, 1961, issue of *Die Casting News* draws attention to some typical applications of zinc alloy die castings, for example, in the Horstmann gas lighter, Shepherd castors, high fidelity loudspeakers, the IBM 026 printing card punch, the Cona coffee maker, and pressure gauges by Barnet Instruments. Free copies are obtainable from the above address.

LEES HALL & SONS, LTD., Newhaven, Sussex. Leaflet covering the company's range of Hemtite heat resisting iron crucibles for melting zinc and other soft metals. Capacities of standard crucibles for aluminium range from 50 to 600 lb., and for zinc, from 125 to 1,500. There are also spouted and plain crucibles with capacities up to 10 cwt. for aluminium and 3 tons for zinc, and lead melting crucibles of various types, up to 12 tons capacity.

THE GENERAL ELECTRIC CO., LTD., Installation Equipment Group Headquarters, Four Ashes, Wolverhampton. Leaflet describing Hidutac switches which are being introduced in 15-, 30-, and 60-amp capacities to supplement the G.E.C. range of Hidutec switchfuses. They are designed for unlimited full load switching and high fault current duty.

C. A. NORGREN, LTD., Shipston-on-Stour, Warwickshire, Micro-Fog application design manual in which this system of lubrication is fully explained for the benefit of the designer and plant engineer. Correct installation is also discussed both for systems which are incorporated at the drawing board stage, and for conversions where improved lubrication is required. Another publication (ENC-2) includes illustrations and descriptions of Micro-Fog equipment which is specially intended for use in machine lubrication.

THE LAPOINTE MACHINE TOOL CO., LTD., Otterspool, Watford By-Pass, Watford, Herts. Well-presented and strikingly illustrated publication entitled "It All Began with Broaching," which gives a concise history of the Lapointe organization from the origination of the broaching process by J. N. Lapointe in 1902.

A factory was subsequently opened in England in 1919, and the British company now has extensive and well equipped premises at Watford. Views are included showing various departments of these works and there is also a section devoted to personalities. The remainder of the publication is devoted to illustrations of various Lapointe machines with brief explanatory notes.

At the Annual Dinner of the Machine Tool Trades Association, which was held at Grosvenor House, London, on November 16, the toast of "The Association" was proposed by The Rt. Hon. Harold Watkinson, M.P., Minister of Defence, and the president, Mr. J. C. Snow, replied. Mr. Snow also proposed the toast of "The Guests," to which The Rt. Hon. Lord Knollys, G.C.M.G., M.B.E., D.F.C., chairman of Vickers, Ltd., responded. The speeches are reported in the supplement to this week's issue. In the photograph on the left are The Rt. Hon. Harold Watkinson, M.P., Minister of Defence (left) and Sir Greville S. Maginness, K.B.E., a past president of the M.T.T.A., and in the photograph on the right (left to right) Mr. T. N. Woof, M.C., chairman, Machine Tool and Small Tool Importers Section Committee, Mr. J. C. Snow, president, and Mr. Robert W. Asquith, a past president of the M.T.T.A.

Industrial Notes

F. J. EDWARDS, LTD., 359-361 Euston Road, London, N.W.1, have been appointed sole agents in the United Kingdom for Belgian-made LVD hydraulic deep-drawing presses.

AIRTECH, LTD., and CHARTAIR, LTD., have merged, the assets and business of the latter having been acquired by the former. The combined businesses will in future be carried on at the Airtech works at Haddenham, Bucks.

GATE MACHINERY CO., LTD., 172-178 Victoria Road, Acton, London, W.3, will stage demonstrations of machine tools in their showrooms from December 11 to 15. Exhibits will include universal and vertical milling machines, centreless and universal grinders, and drilling machines.

AN AUCTION SALE OF MACHINE TOOLS and miscellaneous stores will be held at the W. D. Storage Depot, Royal Arsenal, Woolwich, London, S.E.18, on December 5 to 7. The auctioneers will be Fuller Horsey, Sons & Cassell (Dept. L), 10 Lloyd's Avenue, London, E.C.3.

BERGEN TEMPERED, LTD., a member company of the Tempered Group, have moved to new premises in Sussex Road, Sheffield, 4, where increased floor space is available, and improved production facilities have been provided. The company makes pipe supports for chemical works, power stations, and similar installations.

THE RAWLPLUG CO., LTD., Cromwell Road, London, S.W.7, have purchased additional freehold factory premises known as Brent Works in Colindale Avenue, Hendon, N.W.9, to enable output to be increased to meet the demand for Rawlbolts, Rawlties and other heavy fixing devices.

EMPLOYMENT IN THE MANUFACTURING INDUSTRIES. During September the number of people employed in manufacturing industries increased by 31,000 to 8,994,000. There was a rise of 17,000 in "engineering and electrical goods," of 2,000 in "shipbuilding and marine engineering," 2,000 in "vehicles," and 1,000 in "metal goods." For "metal manufacture" the total was unchanged.

MORGANITE ELECTROHEAT, LTD., Point Pleasant, Wandsworth, London, S.W.18, have been appointed sole distributors in the United Kingdom for Norton Crystolon hot rods and super hot rods. The hot rod is suitable for use as an electric furnace heating element, for temperatures up to 1,575 deg. C., and the super hot rod, which is a new product, permits element temperatures up to 1,700 deg. C.

THE NEW BRITAIN MACHINE CO., U.S.A., announce that they will in future build Morey vertical profiling and milling machines. The complete range of profilers will be made at the Cleveland, Ohio, works of their Lucas Machine Division, including 3-, 4-, and 5-axis types with tracer or numerical control for all movements. These machines will incorporate heads with spindle speeds up to 3,600 r.p.m.

FIRE PROTECTION ASSOCIATION, Garrard House, 31-45 Gresham Street, London, E.C.2. An article in the Summer 1961 issue of the *Fire Protection Bulletin* shows how fire separation can be provided in factories where continuous conveyor systems are installed. In particular it is concerned with methods of preventing the passage of fire and smoke through openings provided for conveyors in fire separating walls.

THE INSTITUTION OF PRODUCTION ENGINEERS, 10 Chesterfield Street, Mayfair, London, W.1, have now published the information which they submitted to the Committee on Higher Education in September. Recommendations are made in connection with the universities and the colleges of advanced technology and two alternatives are discussed, namely, affiliation of college of advanced technology and university, or degree-awarding powers for colleges of advanced technology.

AN INTERNATIONAL INVENTIONS AND COMMERCIAL DEVELOPMENT EXHIBITION—the first of its kind to be held for 10 years—will be staged in the Central Hall, Westminster, from February 16 to 24, 1962. It is being organized by Empson & Turner, Ltd., in association with the Institute of Patentees and Inventors. Further information can be obtained from David Wynne-Morgan & Associates, Ltd., Thorn House, Upper St. Martin's Lane, London, W.C.2.

THE B.S.A. GROUP have formed two new divisions covering General Engineering and Metal Components. The first of these divisions comprises B.S.A. Guns, Ltd., Carbodies, Ltd., Monochrome, Ltd., and a new company, B.S.A. (Redditch), Ltd. In the Metal Components Division there are also four companies, namely, B.S.A. Metal Powders, Ltd., B.S.A. Sintered Components, Ltd., B.S.A. Precision Castings, Ltd., and Idoson Motor Cylinder Co., Ltd.

ENERGY CONVERSION, LTD., is the title of a new company which has been formed by The British Petroleum Co., Ltd., British Ropes, Ltd., and the Guest, Keen and Nettlefolds Group, in conjunction with the National Research Development Corporation, to promote research into the development of fuel cells. The registered offices will be at Britannic House, Finsbury Circus, London, E.C.2. Fuel cells are devices which provide a means of generating electricity directly from chemical energy.

PYE ELECTRIC, LTD. (LOWESTOFT DIVISION), Lowestoft, have equipped a demonstration van with models of standard T.A.S.C. unit controls, and are arranging for visits to be made to engineering works in all parts of the country. The T.A.S.C. unit speed control takes the form of an electromagnetic coupling which is driven by an a.c. motor and enables the speed of the output shaft to be accurately regulated from maximum to 5 per cent of maximum. It can be started and stopped at any speed within the range.

LUCAS-T.V.S. (PRIVATE), LTD., is the title of a new company which is to be formed under a partnership agreement between Joseph Lucas, Ltd., and T. V. Sundaram Iyengar & Sons (T.V.S.) of South India. This new company will manufacture electrical equipment for vehicles to meet the demands of the rapidly expanding Indian motor industry. Capital employed in the company in early years

will amount to more than £2 million, which will include plant and machinery representing a value in excess of £1 million to be supplied by Lucas.

SCHOOL OF WELDING TECHNOLOGY, 54 Princes Gate, Exhibition Road, London, S.W.7. A brochure is available in which are listed the 39 day courses which are now being organized from time to time. Particulars are also included of the courses to be held during the months of December to March, inclusive. In addition, it may be noted, evening courses on design for welding in steel construction will be held from January to March in Bristol and Leeds. There will also be a course in Manchester on detail design of welded structural steelwork.

FIRTH-VICKERS STAINLESS STEELS, LTD., Weedon Street, Sheffield, 9, have announced a scheme for the modernization and re-organization of their facilities for the production of plates and wide sheets, at a total cost of the order of £4,500,000. This scheme, which will be completed in three to four years, will be carried out in stages to avoid undue interference with production. The first stage will involve the replacement of obsolete mills by a new 80-in. wide hot reversing mill, with fully mechanized auxiliary equipment, for the production of plates up to 6-ft. finished width, and in thicknesses from $\frac{5}{16}$ to 1 in.

ROTAX, LTD., Test Equipment Group, Chandos Road, London, N.W.10, have arranged to market an engine indicator of a universal type for use in connection with research in diesel engineering. It takes the form of a cathode ray indicator incorporating circuits for use with resistive, capacitive, and inductive type transducers. The complete engine cycle is displayed on the screen, and measurements of cylinder pressure, injector pump needle lift, and fuel line pressure can be made. In addition, automatic fuel consumption measuring equipment for use in diesel engine test bays is being made available to industry.

TYRE-VALVE PRODUCTION IN NORTHERN IRELAND. The Bridgeport Brass Co., Connecticut, U.S.A., report that they have decided to expand their factory at Lisburn, Northern Ireland, and to increase production considerably beyond that originally envisaged. It is stated that the Lisburn plant will be employed to serve Common Market countries, in preference to establishing other factories for this purpose. At present the Lisburn works have an area of 73,000 sq. ft., and the first production line has recently been installed. Initially, it is planned to produce a range of 100 different types and sizes of tyre valves, in quantities up to several millions per week, and ultimately three production lines will be in operation, and multiple shifts will be worked.

PERSONNEL ADMINISTRATION, LTD., 2 Albert Gate, Knightsbridge, London, S.W.1, have introduced a new service for British business men who are planning to extend their activities on the Continent. This service, which will cover all Western European countries, will provide, for example, for statistical analyses of European markets by volume and location; detailed surveys of market trends and potentials for specific products and industries; reports on the feasibility of establishing manufacturing units in particular countries; and recommendations concerning distributing and marketing arrangements. Enquiries should be sent to the Director of European Services at the above address.

BRITISH STANDARD SPECIFICATION 3401:1961 is concerned with beryllium copper crinkle washers. These washers have been increasingly employed in a wide range of industries during recent years, and the new specification has been published to provide a standard range before an excessive number of variations becomes firmly established. Only washers made from beryllium copper are standardized at present, but washers made from other materials may be considered in the future.

The new specification covers washers in sizes suitable for use with screwed fasteners from 10 B.A. to $\frac{3}{4}$ in. nominal diameter, and it is expected that this range will meet most normal requirements.

Copies of this Standard may be obtained from the British Standards Institution, Sales Branch, 2 Park Street, London, W.1. (Price 3s. each, postage extra to non-subscribers.)

Books Received

FORK TRUCK STABILITY TESTS. British Industrial Truck Association, York Mansion, 94-98 Petty France, London, S.W.1. 12 pp. [Price 2s. 6d.]

This useful booklet includes an introductory section, and gives particulars of recommended tilting platform tests for longitudinal and lateral stability when stacking and travelling.

CABMA REGISTER 1961–62 (NINTH EDITION). Published jointly by Kelly's Directories, Ltd., Neville House, Eden Street, Kingston-upon-Thames, Surrey, and Iliffe Books, Ltd., Dorset House, Stamford Street, London, S.E.1 for the Canadian Association of British Manufacturers and Agencies. 620 pp. [Price 15s. post price.]

This useful directory of British industrial products for Canada has been published annually since 1953 for the purpose of developing the market for those products. It includes a classified list with more than 3,000 product headings and a French glossary. The next section gives particulars of Canadian distributors and Canadian associated companies of United Kingdom firms, and is followed by an alphabetical list of nearly 4,000 British firms with details of distribution arrangements in Canada. In addition, there are sections concerned with proprietary names and trade marks.

LINEAR CIRCUITS. By R. E. Scott. The Addison-Wesley Publishing Co., Ltd., Reading, Massachusetts, U.S.A., and 10-15 Chitty Street, London, W.1. Part 1: 510 pp. [Price 38s. net.] Part 2: 417 pp. [Price 38s.]

Electrical circuit analysis may be tackled many ways, but it is undoubtedly preferable to make full use of certain selected mathematical techniques, such as algebraic topology, singularity functions, complex quantities, the Fourier Theorem, and the Laplace transforms. These and other techniques are explained and applied in masterly fashion by the author. The first part of the book is concerned with resistive-circuit theory and transients in the time domain, and the second part is devoted to steady-state alternating-current theory and transients in the frequency domain.

Of unusual clarity and conciseness, the text includes a large number of illustrative examples. For each chapter there are exercises, to which answers are provided.

Machine Tool Exports and Imports

EXPORTS OF MACHINE TOOLS

Type of Machine	Month ended August 31, 1961	Eight months ended August 31	
		1960	1961
	Value £	Value £	Value £
New, complete:—			
Bar and chucking automatics	105,598	520,016	761,984
Boring machines:			
Vertical	30,063	271,729	653,379
Other	163,091	913,256	753,202
Drilling machines	137,120	851,901	956,803
Gear-cutting machines	143,080	705,635	744,438
Grinding, lapping and honing machines	306,122	1,715,706	2,392,811
Lathes:			
Capstan and turret	190,844	1,391,603	1,947,320
Other	296,077	2,570,289	2,876,658
Milling machines	471,218	1,424,919	2,360,152
Planing machines	7,609	134,568	231,784
Presses:			
Hydraulic	117,874	651,729	914,386
Other	119,637	1,857,207	909,642
Punching and shearing machines	93,104	351,209	507,794
Other plate and sheet-metal working machines, including straightening rolls	77,530	418,504	561,837
Screwing and threading machines	129,042	504,283	656,429
Shaping and slotting machines	57,136	272,796	316,281
All other machines	359,525	1,702,443	2,355,826
Used, complete	57,931	814,629	544,883
Parts	319,944	2,065,855	2,558,664
Total	3,182,545	19,138,277	23,004,273
Destination			
India	195,119	2,282,593	2,955,419
Australia	150,289	4,240,142	2,679,534
New Zealand	75,779	276,894	586,005
Canada	118,690	927,995	1,037,343
Other Commonwealth countries	219,333	1,032,410	1,278,276
Union of South Africa	140,768	877,850	1,013,594
Soviet Union	9,483	259,298	550,217
Sweden	92,158	502,356	769,330
Western Germany	186,968	643,636	1,317,118
Netherlands	73,563	405,349	571,925
France	207,415	1,177,302	1,182,490
Spain	53,276	309,347	618,329
Italy	120,087	498,436	1,540,596
United States of America	113,941	1,726,232	829,510
Other foreign countries	1,425,676	3,978,437	6,074,557

IMPORTS OF MACHINE TOOLS

New, complete:—			
Bar and chucking automatics	133,001	408,219	708,074
Boring machines	153,910	921,334	1,090,344
Drilling machines	43,667	203,336	323,252
Gear-cutting machines	87,328	452,168	1,317,518
Grinding, lapping and honing machines	406,765	2,806,254	3,149,199
Lathes	250,817	1,458,368	2,432,288
Milling machines	221,239	2,115,313	2,315,149
Planing, shaping and slotting machines	25,046	312,652	381,382
Presses	163,075	998,606	1,341,221
All other machines	688,414	2,482,553	4,196,888
Used machines, complete	109,984	826,097	605,095
Parts	382,851	2,083,215	2,652,545
Total	2,666,097	15,068,115	20,512,955
Country of Origin			
Western Germany	864,699	4,347,518	5,928,088
Switzerland	212,808	2,051,161	2,183,807
U.S. America	991,800	6,049,191	8,079,440
Other countries	596,790	2,620,245	4,321,620

MACHINERY'S ENQUIRY BUREAU

For many years MACHINERY has provided an enquiry service not only for subscribers and advertisers but for all engineers in need of such information as the names of makers—or their agents—of machines or equipment for performing particular operations, suppliers of various classes of material, firms with facilities for undertaking certain types of work, owners of trade names, and agents for foreign machine builders. If you have such a problem write (MACHINERY, Enquiry Bureau, Clifton House, 83-117 Euston Road, London, N.W.1) or telephone (Euston 8441, 2 lines). This service is, of course, entirely free.

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22/11/61

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Personal

MR. F. V. BARKER, who has been a director of Vauxhall Motors, Ltd., Luton, since 1955, will resign at the end of November under the terms of the company's retirement programmes.

The following new appointments have been announced:—

MR. G. H. DOUST as a director of Plessey International, Ltd., Ilford, Essex.

MR. C. W. PAGE as sales manager of the Industrial Division of Castrol Industrial, Ltd., Castrol House, Marylebone Road, London, N.W.1. This post has been newly created.

MR. W. G. BOND, as a joint general manager of Elliott Brothers (London), Ltd., Lewisham, London, S.E.13, a member company of the Elliott-Automation Group.

MR. GODFREY YEM, A.M.I.M.E., M.Inst. of R., as a director of The Lightfoot Refrigeration Co., Ltd., Abbeydale Road, North Circular Road, Wembley, Middlesex. He was previously general manager of the company.

MR. ARTHUR G. JONES, general works manager, as works director, and MR. WILLIAM R. MILLS, general sales manager, as sales director of Stanley Works (G.B.), Ltd., Rutland Road, Sheffield, 3.

MR. A. H. SCOTTORN, of 51 Kenmore Crescent, Northville, Bristol, 7, as sales engineer for Cornwall, Devon, Somerset, Dorset, Glos., Wilts., Bucks. (excluding Aylesbury) and Oxon., and MR. R. H. ASHBEE, of 88 Oundle Road, Orton Longueville, Peterborough, as sales engineer for Notts., Lincs., Leics., Northants., and Rutland, by Normand Electrical Co., Ltd., North Street, Clapham Common, London, S.W.4.

Obituary

DR. EDWIN GREGORY, M.Sc.(Lond.), Ph.D., A.Met., M.I.Chem.E., M.I.E.I., F.I.M., F.R.I.C., died recently at the age of 67. He had been a director of Edgar Allen & Co., Ltd., for 15 years, and chief metallurgist from 1944 until he retired from executive duties in March, 1961.

MR. R. D. MACMILLAN, managing director of Controlled Heat & Air, Ltd., Cornwall Road, Smethwick, a member company of the Incandescent Group, died on November 8 at the age of 57. He served his apprenticeship with A. & J. Inglis, Ltd., and joined Controlled Heat & Air, Ltd., in 1933, as chief designer. He had held the office of managing director since 1945.

Coming Events

INSTITUTION OF PRODUCTION ENGINEERS. *Lincoln Section.* November 30, at 7.30 p.m., at the Ruston Club, Lincoln; lecture on "Numerically-controlled Machine Tools," by R. C. Brewer. *Halifax and Huddersfield Section.* December 4, at 7.30 p.m., in the Lecture Theatre, Engineering Tower, Huddersfield Technical College; lecture on "Work Study," by F. T. Mountford.

INSTITUTION OF ELECTRICAL ENGINEERS. *Scottish Electronics and Measurement Group.* December 4, at 6 p.m., at the Royal College of Science and Technology, Glasgow, C.1; lecture on "Precision Measurement," by A. Felton, B.Sc.(Eng.), and G. H. Rayner, B.A. *Rugby Sub-Centre,* November 29, at 6.30 p.m., at Rugby College of Engineering Technology; lectures on "An Oscillating Synchronous Linear Machine," by E. R. Laithwaite, M.Sc., Ph.D., and R. S. Mamak, and "The Application of Linear Induction Motors to Conveyors," by E. R. Laithwaite, M.Sc., Ph.D., D. Tipping, B.Sc., and D. E. Hesmondhalgh, M.Sc.

INSTITUTION OF PLANT ENGINEERS. *South Wales Section.* November 28, at 7 p.m., at the Electricity Showrooms, 62 Kingsway, Swansea; lecture on "Design for Maintenance," by R. N. Dale.

Scrap Metals

†LONDON.—‡Prices per ton for non-ferrous scrap metals free from iron are as follows:—Clean copper wire, untinned and free from lead and solder, £193; clean heavy copper, untinned and free from lead and solder, £185; copper wire No. 2, £175; clean light copper, £175; brazery copper, £151; gunmetal, £164; brass, mixed, £121; lead, net, £44; zinc, £26; cast aluminium, £80; old rolled aluminium, £88; battery lead, £21; unsweated brass radiators, £96; hollow pewter, £570; black pewter, £450.

MIDLANDS.—The depressed trading conditions which for some time have seriously affected the values of aluminium, lead and zinc seem to be extending, if only temporarily, to tin and certain grades of copper. In general, users of scrap appear to be adopting a policy of caution as regards prices offered and are maintaining a close watch on quality, as a result of sufficient stocks and a lessening demand for finished products.

Tin had gained steadily, but during the last few days there have been some sharp falls and the scarcity does not appear so acute as it did a short time ago. Copper, after some fluctuations in a rather sensitive market, has remained practically unchanged in value.

The position as regards metals mainly affected by changing market values is as follows:—

Copper.—Demand is fairly steady for the better grades but sellers of No. 2 wire and brazery material find that the differences in price are tending to widen.

Brass.—There has been a slight easing in the value of mixed scrap, but for most grades there are reasonably steady outlets.

Gunmetal.—With a slackening of demand from the ingot makers, the price of scrap has eased by £2 to £3 per ton.

Lead.—Production is considerably in excess of demand and there has been a further fall of about £4 per ton in the price of scrap—a frustrating market with an uninspiring future.

Aluminium.—Values remain unchanged in a featureless market. Prices for swarf, old rolled and cast material are very low, and the latter is difficult to move. With activity in the motor industry generally low, no better price tone can be foreseen in the near future.

Zinc.—Prices for most grades have fallen by about £3 per ton.

† George Cohen, Sons & Co., Ltd., 600 Wood Lane, London, W.12.
‡ Subject to market fluctuations.

Machine Tool Share Market

Stock markets were firm during the period under review, and turnover, although moderate, showed a tendency towards gradual expansion. The gilt-edged market remained steady, and although movements were not extensive, British Funds and similar fixed interest stocks closed with a general improvement.

In commercial and industrial share markets there was a broadening of interest, and the trend, in the main, was for prices to move to higher levels. As a result of a fair amount of selective buying, leading sections finished on a good note.

Among machine tool issues, Arnott & Harrison advanced 1s. to 12s.; Asquith Machine Tool, 6d. to 10s. 6d.; Birmingham Small Arms, 1s. 6d. to 22s. 6d.; Chas. Churchill, 3d. to 8s. 10½d.; Clarkson (Engineers), 3d. to 6s. 6d.; Coventry Gauge & Tool, 3d. to 29s. 6d.; Craven Bros. (Manchester), 6d. to 9s.; B. Elliott, 3d. to 2s. 9d.; John Harper, 6d. to 8s. 3d.; Alfred Herbert, 3s. to 64s.; John Holroyd "B", 4s. 3d. to 20s.; W. E. Norton (Holdings), 1s. to 9s. 6d.; Samuel Osborn, 3s. 9d. to 53s. 9d.; Ambrose Shardlow, 2s. 6d. to 55s.; Scottish Machine Tool, 6d. to 7s. 9d.; Tap & Die Corporation, 1s. 3d. to 19s.; and Wadkin Ltd., 6d. to 26s. 6d.

On the other hand, British Oxygen Co. lost 6d. at 15s. 6d.

BIRMINGHAM SMALL ARMS CO., LTD. Final dividend 7⅜ per cent, making a total distribution of 11⅜ per cent for the year ended July 31.

JOHN HOLROYD & CO., LTD. Final dividend of 10 per cent, making, with the interim, a total distribution of 15 per cent.

Index to MACHINERY

The index to MACHINERY, Volume 98, which covers the period from January 1 to June 30, 1961, is now available and copies are obtainable free of charge by subscribers on application to the Publishing Department, Machinery Publishing Co., Ltd., National House, 21 West Street, Brighton, 1.

Display of Turning Technique

Elgar Machine Tool Co., Ltd., will stage a special display of modern European turning techniques in their showrooms at 172-178 Victoria Road, Acton, London, W.3., from February 5 to 16, 1962.

COMPANY		Denom.	Middle Price
Abwood Machine Tools, Ltd.	Ord.	1/–	1/3
Allen (Edgar) & Co., Ltd.	Ord.	£1	32/–
" " "	5% Prf.	£1	13/3
Arnott & Harrison, Ltd.	Ord.	4/–	12/–
Asquith Machine Tool Corp., Ltd.	Ord.	5/–	10/6
" " "	6% Cum. Prf.	£1	16/6
Birmingham Small Arms Co., Ltd.	Ord.	10/–	22/6xd
" " "	5% Cum. "A" Prf.	£1	13/–
" " "	6% Cum. "B" Prf.	£1	16/6
" " "	4% 1st Mort. Deb.	Stk.	91½
British Oxygen Co., Ltd.	Ord.	5/–	15/6
" " "	6% Cum. Prf.	£1	18/6xd
Brooke Tool Manufacturing Co., Ltd.	Ord.	5/–	8/–
Broom & Wade, Ltd.	Ord.	5/–	25/3
" " "	6% Cum. Prf.	£1	16/–
Brown (David) Corporation, Ltd.	5¼% Cum. Prf.	£1	14/–xd
Buck & Hickman, Ltd.	6% Cum. Prf.	£1	17/–
Butler Machine Tool Co., Ltd.	Ord.	5/–	15/–
" " "	5% Cum. Prf.	£1	12/6
Churchill (Charles) & Co., Ltd.	Ord.	2/–	8/10½
" " "	6% Cum. Prf.	£1	25/7½‡
Clarkson (Engrs.), Ltd.	Ord.	1/–	6/6
Cohen (George), 600 Group, Ltd.	Ord.	5/–	10/–
" " "	4½% Cum. Prf.	£1	12/–
Coventry Gauge & Tool Co., Ltd.	Ord.	10/–	29/6
" " "	5% Cum. Red. Prf.	£1	16/3
Craven Bros. (Manchester), Ltd.	Ord.	5/–	9/–
Elliott (B.) & Co., Ltd.	Ord.	1/–	2/9
" "	4½% Red. Cum. Prf.	£1	11/3
Firth Brown Tools, Ltd.	4% Cum. Prf.	£1	10/6
Greenwood & Batley, Ltd.	Ord.	10/–	14/3
Harper (John) & Co., Ltd.	Ord.	5/–	8/3
" " "	4½% Red. Cum. Pref.	£1	9/6
Herbert (Alfred), Ltd.	Ord.	£1	64/–
Holroyd (John) & Co., Ltd.	"A" Ord.	5/–	20/–
" "	"B" Ord.	5/–	20/–
Jones (A. A.) & Shipman, Ltd.	Ord.	5/–	25/–
" " "	7% Cum. Prf.	5/–	4/6
Kearney & Trecker-C.V.A., Ltd.	5½% Red. Cum. Prf.	£1	8/9
" " "	Prefd. Ord.	£1	13/9
Kearns (H. W.) & Co., Ltd.	Ord.	5/–	22/3
Kerry's (Gt. Britain), Ltd.	Ord.	5/–	8/6xd
Macreadys Metal Co., Ltd.	Ord.	5/–	15/–
Martin Bros. (Machinery), Ltd.	Ord.	2/–	2/6
Massey (B. & S.), Ltd.	Ord.	5/–	11/–
Newall Engineering Co., Ltd.	Ord.	2/–	7/–
Newman Industries, Ltd.	Ord.	2/–	7/–
" " "	6% Prf. Ord.	5/–	5/–
Noble & Lund, Ltd.	Ord.	2/–	5/–
Norton, W. E. (Holdings), Ltd.	Ord.	2/–	9/6
Osborn (Samuel) & Co., Ltd.	Ord.	5/–	53/9
" " " "	5½% Cum. Prf.	£1	22/–
Pratt (F.) Engineering Corporation, Ltd.	Ord.	5/–	14/6
Sanderson Kayser, Ltd.	Ord.	10/–	34/9
" " "	6½% Cum. Prf.	£1	16/3
Scottish Machine Tool Corporation, Ltd.	Ord.	4/–	7/9
Shardlow (Ambrose) & Co., Ltd.	Ord.	£1	55/–
Shaw (John) & Sons, Wolverhampton, Ltd.	Ord.	5/–	14/6
Sheffield Twist Drill & Steel Co., Ltd.	Ord.	4/–	21/6
" " "	5% Cum. Prf.	£1	13/3
Stedall & Co., Ltd.	Ord.	5/–	7/6
Sykes (W. E.), Ltd.	"B" non-voting Ord.	10/–	24/3
Tap & Die Corporation, Ltd.	Ord.	5/–	19/–
" " "	4½% Deb. 1961-1977	Stk.	81½xd
Wadkin, Ltd.	Ord.	10/–	26 6
Ward (Thos W.), Ltd.	Ord.	£1	66/3
" "	5% Cum. 1st Pref.	£1	13/6
" "	5% Cum. 2nd Pref.	£1	20/–
Willson Lathes, Ltd.	Ord.	1/–	2/6

The Middle Prices given in the list are in several cases nominal prices only and not actual dealing prices. Every effort is made to ensure accuracy, but no liability can be accepted for any error. * Sheffield price. ‡ Birmingham price.

PRICES OF MATERIALS

All prices per ton except where otherwise stated.

Pig Iron* (10 tons or over)

Foundry and Forge No. 3, Class 2

Middlesbrough	£21 17 0
Birmingham	£21 9 3

Phos. Over 0·1 up to 0·4%

Birmingham	£23 5 0
Grangemouth	£23 10 0

Hæmatite

N.E. Coast (made in N.E.)	£23 19 0
Scotland (made in Scotland, zone S.1.)	£24 5 6
Sheffield	£25 9 0
Birmingham	£25 13 0
S. Wales (made in Wales)	£23 19 0

Steel Products*

Medium plates (50 tons and over)	£43 16 6
Mild steel plates, ordinary (50 tons and over)	£40 7 0
Boiler plates (50 tons and over)	£42 17 0
Flat bars, 5 in. wide and under (50 tons or over)	£39 1 0
Round bars, under 3 in. (50 tons or over)	£39 1 0
Billets, rolling quality, soft U.T. (100 tons or over)	£31 15 6

Phosphor Bronze

Ingots (2B8) (A.I.D.) d/d	£312 0 0

Copper

Cash (mean)	£229 2 6
Cold rolled and hot rolled sheets 4 ft. by 2 ft. by 10 SWG	£303 15 0—£321 10 0
Rods, $\frac{7}{16}$in. to $\frac{1}{2}$ in. diam	£326 0 0
Tubes, $1\frac{1}{2}$ in. bore by 10 SWG, ton lots, per lb.	3s. $1\frac{1}{2}$d.
Wire rod, black, hot-rolled ($\frac{1}{2}$- $\frac{7}{16}$in.), English	£244 12 6

Zinc

Refined, minimum 98 per cent purity, current month (mean)	£67 18 9

Brass

Tubes, solid drawn, basis per lb.	1s. $9\frac{1}{2}$d.
Strip 63/37, 6in. by 10 SWG coils, ton lots	£256 10 0—£259 10 0
Rods, $\frac{1}{2}$-3 in. diam. (59 per cent copper)	1s. $11\frac{1}{2}$d.

Yellow Metal

Condenser plates, per ton	£184 0 0
Rods, per lb.	2s. $0\frac{1}{2}$d.

Aluminium

Ingots, min. 99·5 per cent Canadian d/d	£186 0 0

Tinplates

**U.K. Home trade: Cold reduced, f.o.r. makers works (15-50 tons)	£3 7 $8\frac{1}{4}$
U.K. Export: Cold reduced basis, f.o.r. works port	73s. 6d.—76s. 0d.

Gunmetal

Ingots, B.S. 1400 L.G.2, delivered	£208 0 0

* Subject to increase of 1 per cent.

**Subject to allowances and extras.

MAKERS' PRICES

Hexagon Steel Bars[1]

Sizes in inches from 1 in. up to 2·21 and 2·41 a/f ex works, 2 tons basis	£42 17 6†
Free cutting black	£46 14 6†

Reeled Steel Bars[1]

Single-reeled, $1\frac{1}{2}$ in. upwards, f.o.t. works (+ usual extra for sizes)	£43 9 0†
Free cutting	£47 7 0†

Precision-ground Mild Steel[2]

1-in. diam ± 0·00025-in. 4-ton lots, per cwt.	124s. 6d.†

Bright Ground Stainless Steel Bars[3]

EN56AM (martensitic, free cutting)	£304 10 0
EN58AM (austenitic free cutting)	£377 10 0

Prices are basic, subject to extras.

High-speed Steel

Black random length bar. All prices basic, per lb., subject to extras:

Molybdenum "66"	6s. 5d.
Molybdenum "46"	6s. 3d.
14 per cent tungsten	6s. 11d.
16 per cent tungsten	7s. 4d.
18 per cent tungsten	7s. 9d.
22 per cent tungsten	9s. 2d.
5 per cent cobalt	10s. 10d.
4·75/5·25 molybdenum + 6·0/6·75 tungsten + 1·75/2·05 vanadium per cent (5-6-2)	6s. 7d.

Precision-ground, High-speed Free-turning Brass Rod[2]

$\frac{1}{8}$-in. diam. ±0·00025-in., 2 ton lots, per lb.	2s. $7\frac{1}{2}$d.

Grey Iron Rod

Die Cast[4] in random lengths 18 in. to 26 in. rough machined $\frac{1}{32}$-in. above listed size. Extra for definite lengths. Discounts for orders over £150.

	Per cwt. net. Mark I	Mark III
$\frac{3}{4}$ or $\frac{7}{8}$ in.	260s. 3d.	338s. 3d.
1 or $1\frac{1}{4}$ in.	208s. 4d.	267s. 3d.
$1\frac{1}{2}$ to $1\frac{3}{4}$ in.	146s. 3d.	181s. 7d.
$1\frac{3}{4}$ to 2 in.	112s. 7d.	133s. 6d.
$2\frac{1}{2}$ to $3\frac{1}{2}$ in.	97s. 1d.	112s. 9d.
$3\frac{1}{2}$ to 12 in.	91s. 9d.	105s. 3d.

Continuous Cast

Centreless machined, 10-ft. lengths 1 to 3-in. diam. + 0·010 to 0·020 in., prices as quoted for die cast bar[4]

Centreless ground +0·010 in. (Extra for hardenable alloy iron)[5]	1 or $1\frac{1}{4}$ in.	208s. 4d.
	$1\frac{1}{2}$ to $1\frac{3}{4}$ in.	146s. 3d.
	$1\frac{3}{4}$ to 2 in.	112s. 7d.
Per cwt. net.	$2\frac{1}{2}$ to $3\frac{1}{2}$ in.	97s. 1d.

Stellite[6]

Welding Rods, plain

$\frac{1}{4}$ in. diam., per lb.	30s. 0d

Toolbits

$\frac{1}{4}$ in. sq. × 4 in., each	22s. 3d.

[1] Colvilles, Ltd., Glasgow, and 17 Grosvenor Street, London, W.1. [2]Pratt, Levick & Co., Ltd., Chester. [3] Spartan Steel & Alloys, Ltd., St. Stephens Street, Birmingham, 6. [4] Sheepbridge Alloy Castings, Ltd., Sutton-in-Ashfield. [5]"Flocast," Harold Andrews Sheepbridge, Ltd., Halesowen, [6]Deloro Stellite, Ltd., Swindon Road, Stratton St. Margaret, Swindon.

† Plus 1 per cent.

BASIC PRICES FROM LONDON STOCK[6]

Free Cutting Steel

Bright cold drawn: (Usaspead) over 1 to 2 in.	£59 4 6‡
Lead bearing (Usaled)	£63 11 0‡
Precision ground, $1\frac{3}{4}$ in.	£84 14 6‡

Bright Drawn

M.S. bars (M.M.C.) over $1\frac{1}{2}$ to 2 in.	£56 10 0‡
Square edge flats (Useflat)	£73 6 6‡
M.S. angles (Usaspead)	£100 6 6‡
Case hardening (EN) (Usacase) over $1\frac{1}{2}$ to 2 in.	£62 10 0‡
M.S. bars (EN3B) (Usamild) over $1\frac{1}{2}$ to 2 in.	£58 16 6‡
Carbon manganese semi-free cutting case hardening (EN202) (Usaspead 202) over $1\frac{1}{2}$ to 2 in.	£71 5 0‡
35/45 ton tensile (EN6) (Usen) over 1 to $1\frac{1}{2}$ in.	£67 3 0‡
0·4 carbon normalized (Usaspead "40") over $1\frac{1}{2}$ to 2 in.	£69 5 0‡
0·45 carbon normalized EN9 (Usaspead 55)	£69 15 0‡
Carbon manganese steel to Specification EN16T (Usaspead 5565), per ton	£127 1 6

Ground Flat Stock

18-, 24-, and 36-in. lengths (Usaspead). List prices plus 10 per cent less 5 per cent.

Oil Hardening Cast Steel

Non-shrink (Usaspead N.S.O.H.), $\frac{1}{4}$ in. to $2\frac{1}{2}$ in. per lb.	1s. 11d.
Non-distorting heavy duty (Usaspead H.C.H.C.), $\frac{1}{4}$ in. to $2\frac{1}{2}$ in., per lb.	4s. 2d.

Silver Steel

(0·194-in. to $1\frac{1}{4}$-in.).

Genuine Stubs quality, per lb.	4s. 10d. less 27½%
M.M.C. quality, per lb.	2s. 8d. + 6¼%

Stainless Steel

R KE40AM (free cutting), per lb.	3s. 4d.

Glacier Machined Bronze Bars

Phosphor bronze (2B8)	Prices on application
Lead bronze	

High-speed Steel

18 per cent tungsten. Prices on application

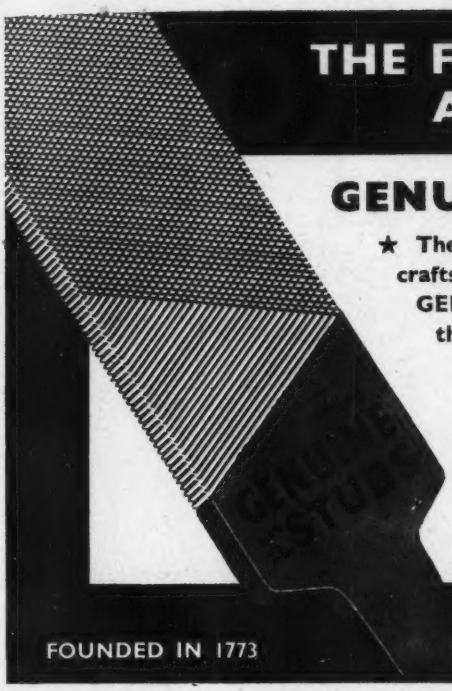
Toolholder bits: Usaspead "Super"	List price
" "Supreme"	
" Cobalt 10	

Shimstock

Steel assorted, per tin	3s. 6d.
Brass " "	7s. 3d.

[6] Macready's Metal Co., Ltd., Pentonville Road, N.1. Subject to confirmation by London Office. Delivered free by van in London area.

‡ Plus 1 per cent.



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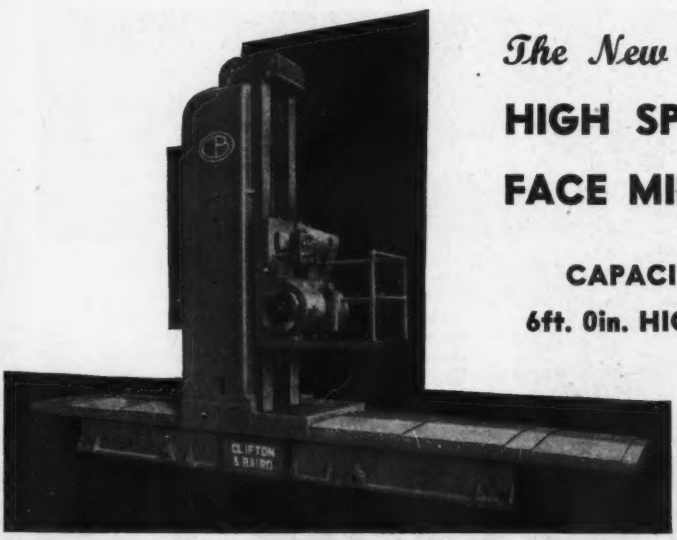

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CAPACITY FOR SURFACES
6ft. 0in. HIGH by 10ft. 6in. LONG

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Available in a variety of types to suit most requirements, SOC press feeds are easy to fit and trouble-free in operation.
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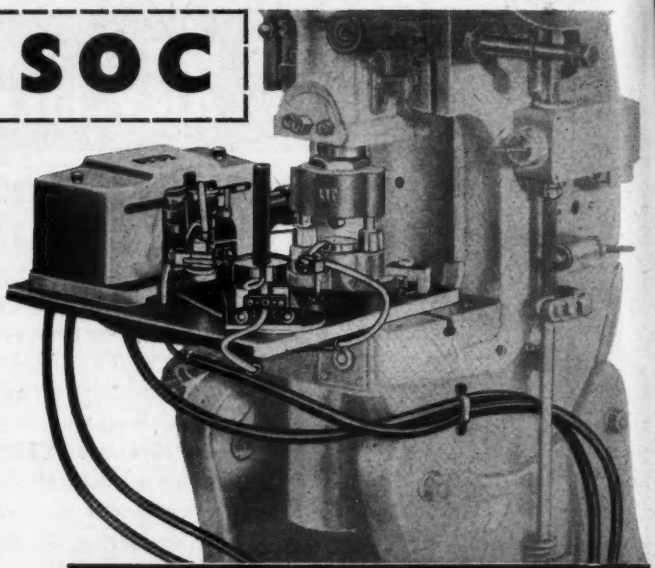

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Designed for use with "Ward" 2A, 3A or "Herbert" 2D and 4 Senior Capstans and Air operated Lathes, this oversize collet chuck enables second operation work up to four inches diameter to be accommodated but retains all the benefits of a ball chuck. Can now be supplied as an Air Chuck to suit any lathe.

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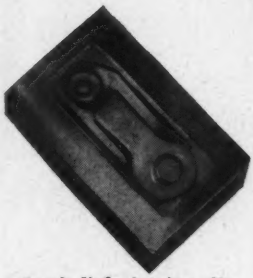
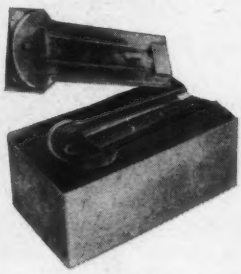
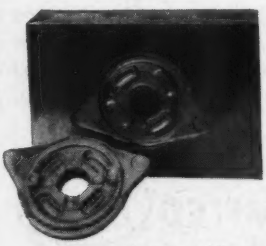


Track link forging die



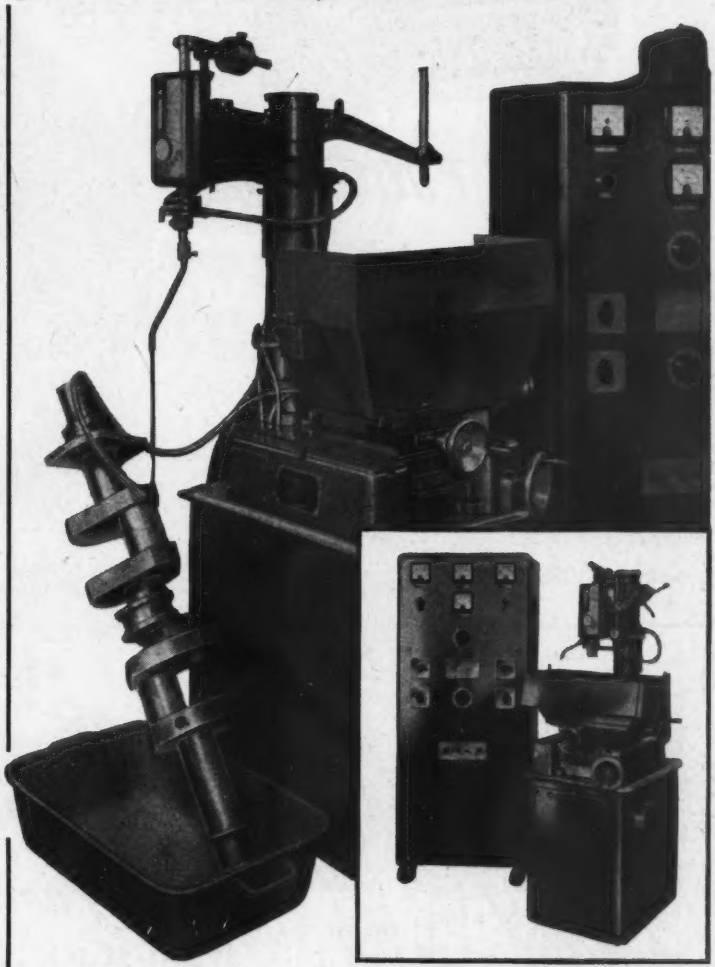
Compressor blade die

Brass stamping die



Die casting mould

Some examples of the types of dies now being produced with Sparcatron equipment.



A typical example of the versatility of the standard MK.IIIA Sparcatron Die Making Machine with the head swung to the side removing the broken drill from a large crankshaft too big to be accommodated in the table tank.

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SPARCATRON (MANUFACTURING) LTD.
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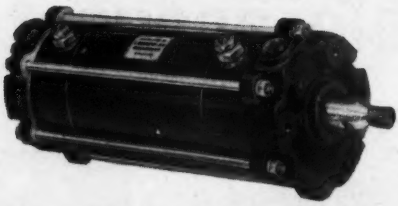

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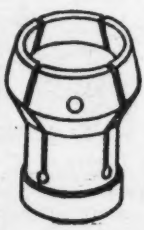

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The London Stockists for Crawford Collets and Chucks.

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Maximum dead length collet capacity	11/16"
Centre height	4"
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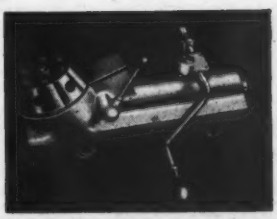

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TOOLROOM VERSATILITY with

ROSENFORS

PRECISION MILLING MACHINES

Are built as plain, universal, vertical and production types, having a table size 59" x 12", with respective movements of 35" longitudinal, 10¾" transverse and 16¾" vertical. Power feeds (16) and rapid traverse to all movements are by means of a separate motor in the totally enclosed knee. There are 18 spindle speeds (33-1,500 r.p.m.) from a 7½ h.p. motor.

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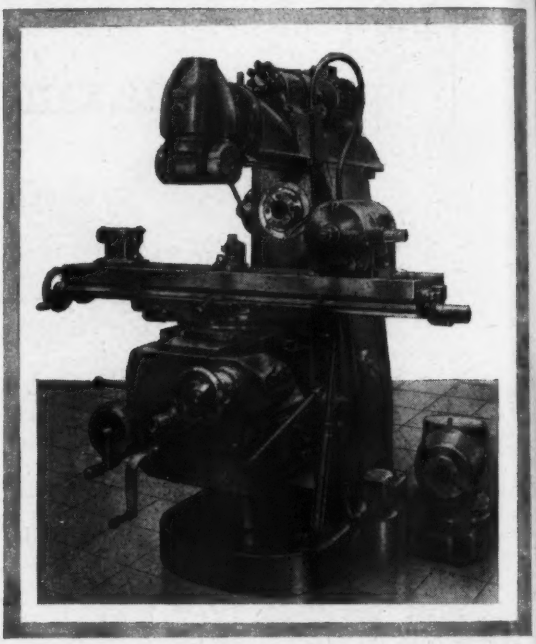

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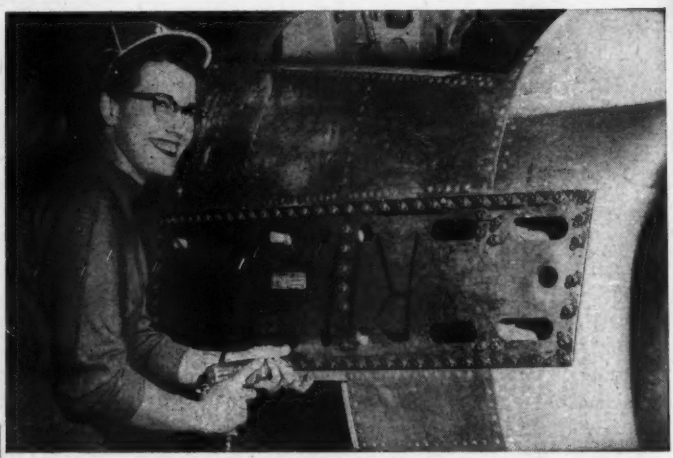

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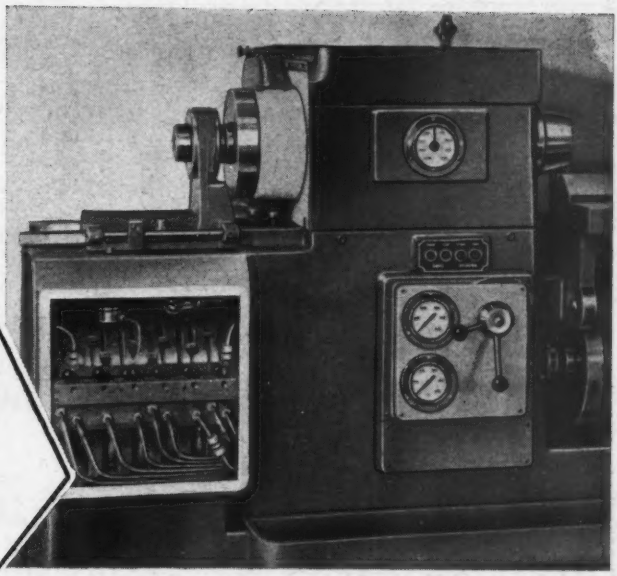

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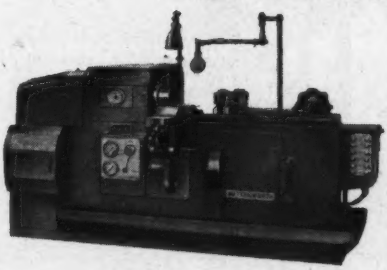

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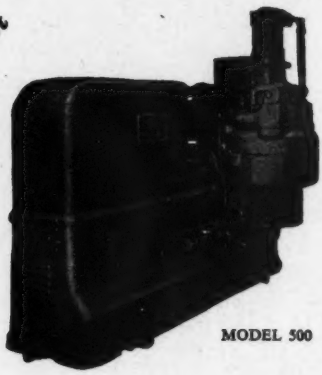

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DIECASTING MACHINES

The castings from this machine are first class precision diecastings possessing

★ LIGHTNESS ★ STRENGTH
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- *Filter Resistance Halved*
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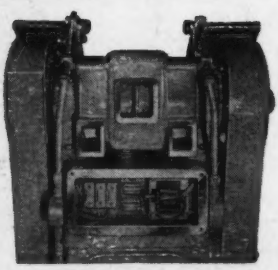

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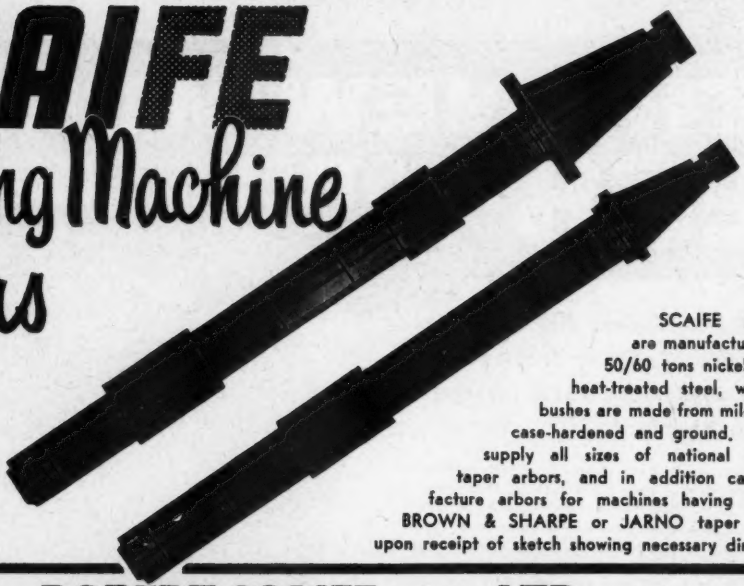

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SCAIFE ARBORS are manufactured from 50/60 tons nickel chrome heat-treated steel, whilst the bushes are made from mild steel—case-hardened and ground. We can supply all sizes of national standard taper arbors, and in addition can manufacture arbors for machines having MORSE, BROWN & SHARPE or JARNO taper spindles upon receipt of sketch showing necessary dimensions.

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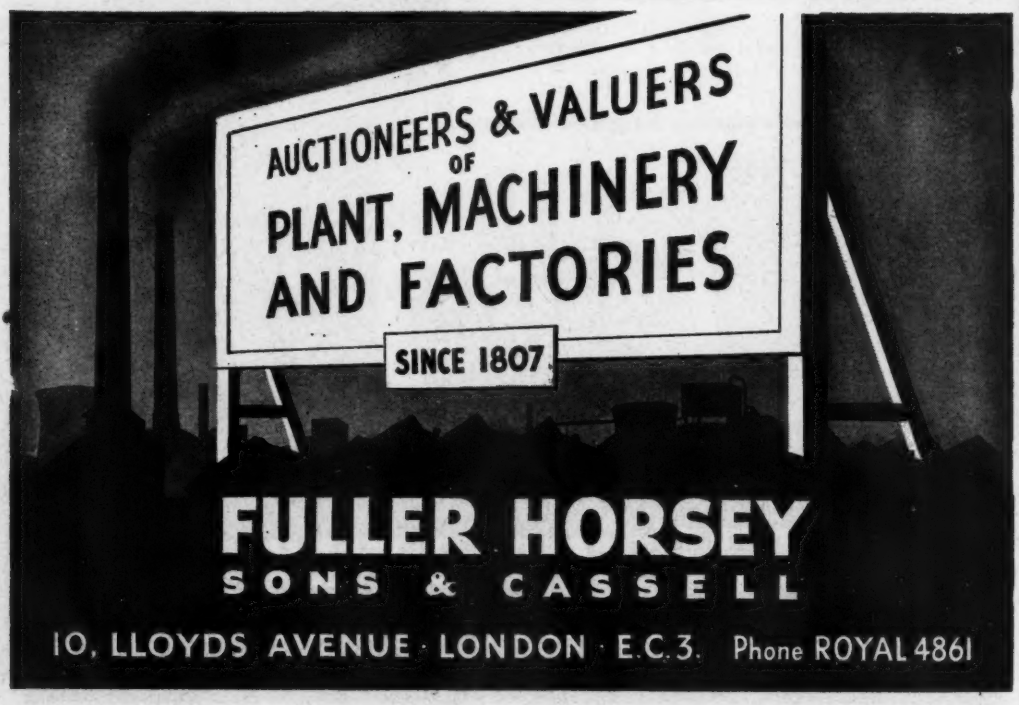

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Look at these advantages

- *No Drilling Jigs*
- *No Marking Out*
- *Fully Automatic*
- *Tape or Dial Setting*
- *Table Positional Accuracy to ±.001"*

This machine will accurately position holes up to 2in. diameter in steel. It eliminates all marking off as well as the necessity of using drilling fixtures. Once the tape has been punched — a relatively simple operation — exact repetitions of even the most complicated drilling jobs are guaranteed at any time. The price of this machine, complete with positioning control system, compares favourably with a conventional drilling machine of the same capacity. Either single or multi-station turret heads can be fitted. May we send you more details?

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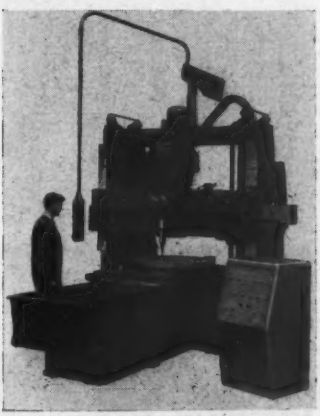

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EUREKA MEK, Oslo

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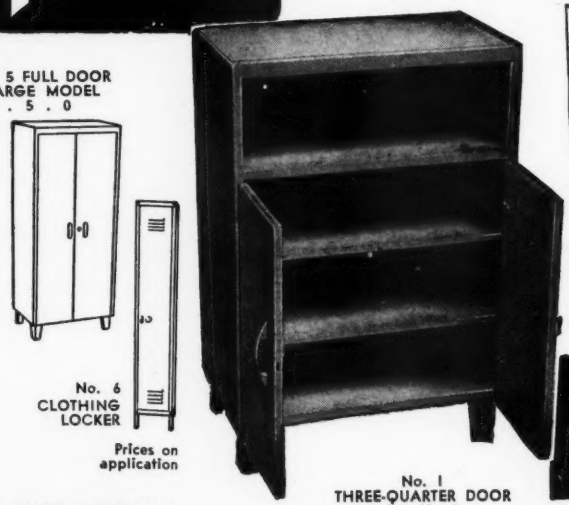

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No. 6 CLOTHING LOCKER

Prices on application

MADE IN SCOTLAND

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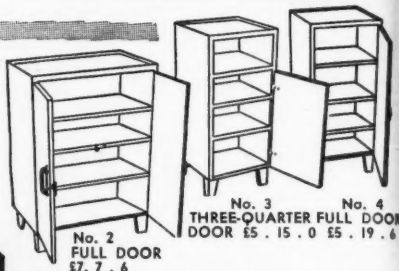

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A type for every purpose!

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REGD. TRADE MARK

SELF-LOCKING

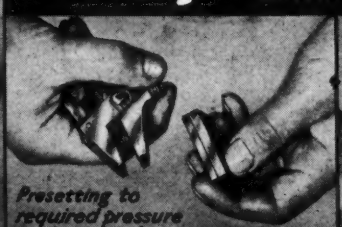
Plier Clamp

The First Tool in the World to Combine Secure Locking with Parallel Jaw opening.

BRITISH PATENTS 576142, 731731 also Foreign Patents

Setting the jaws to required distance with adjusting screw

- *Jaws open to ½" . . . . always parallel*
- *Ratio of gripping pressure to hand pressure about 150 to 1*
- *Can be used as fixture or as hand tool*
- *Simple to use yet so sure in its action*



Presetting to required pressure with same adjusting screw

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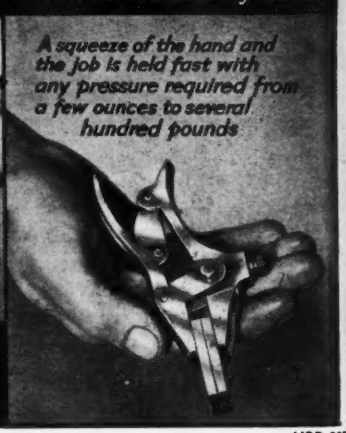

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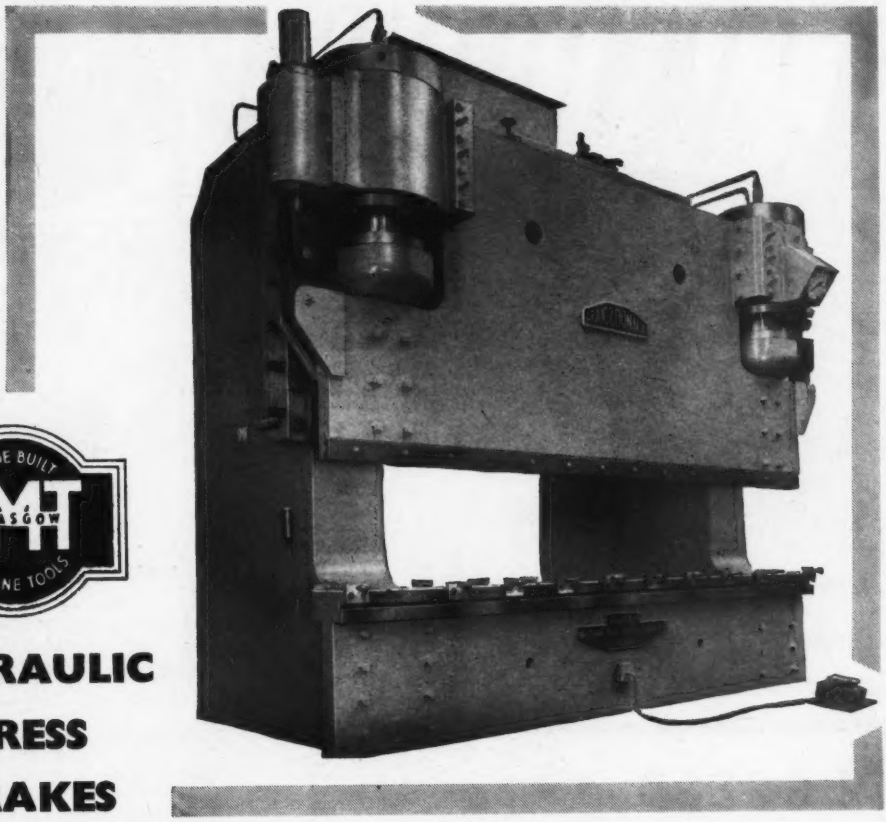

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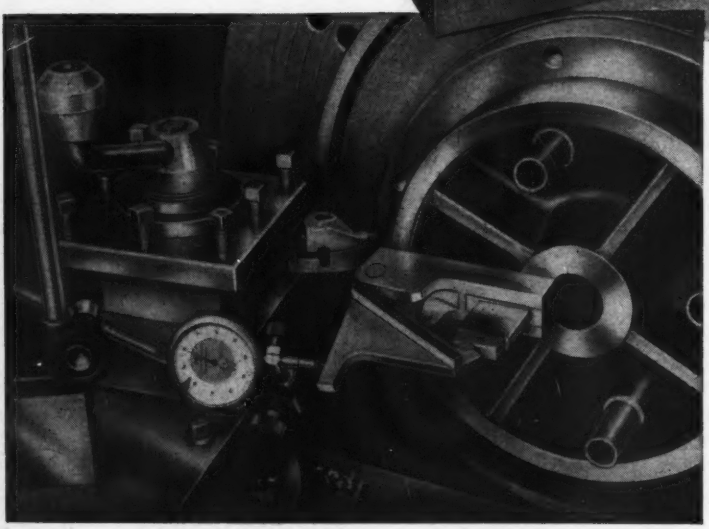

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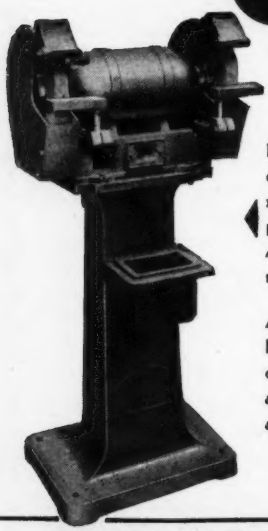

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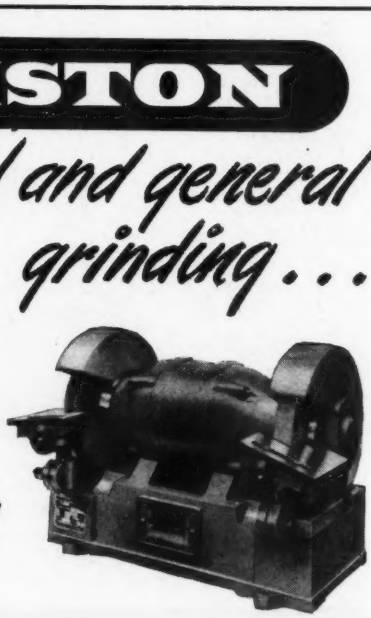

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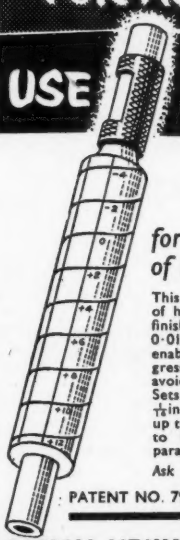

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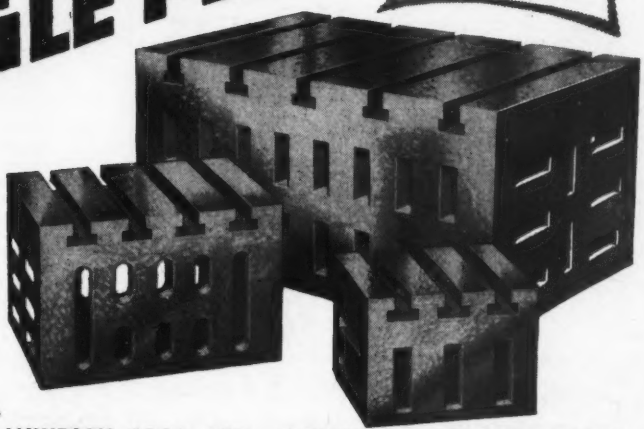

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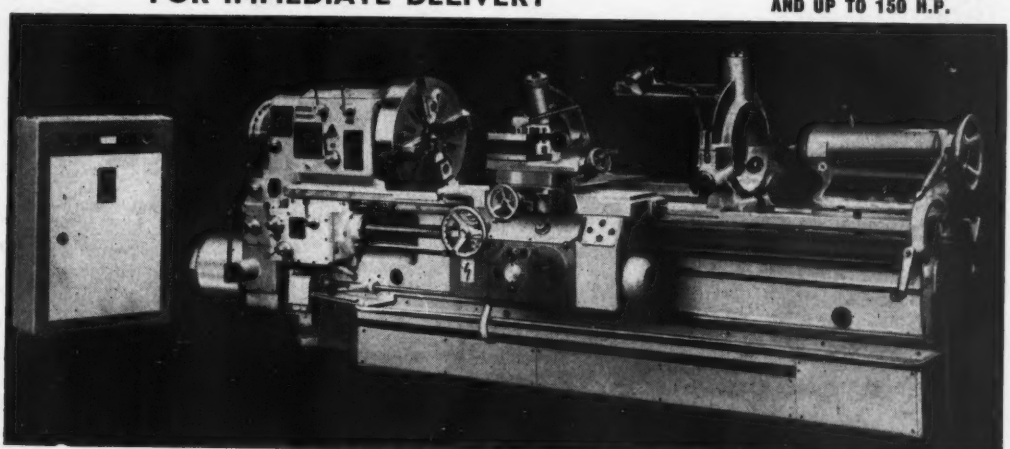

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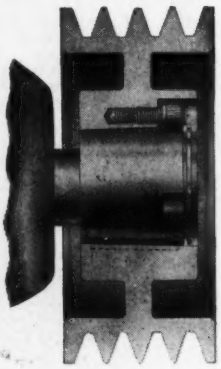

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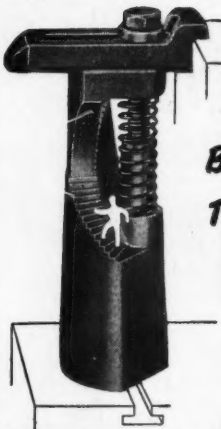

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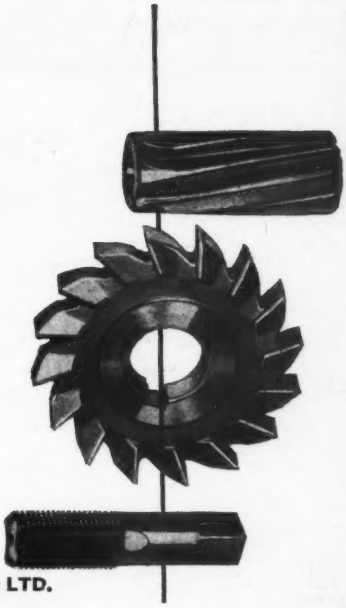

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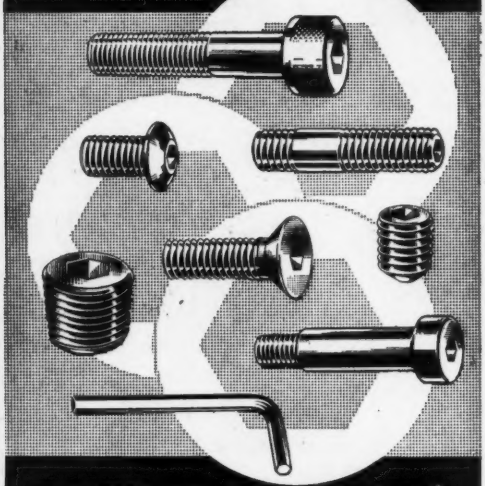

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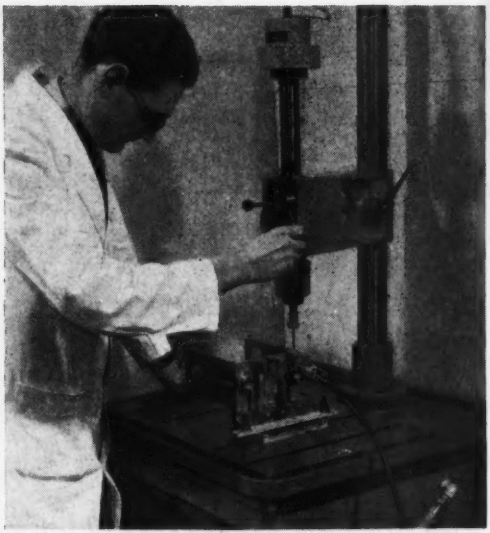

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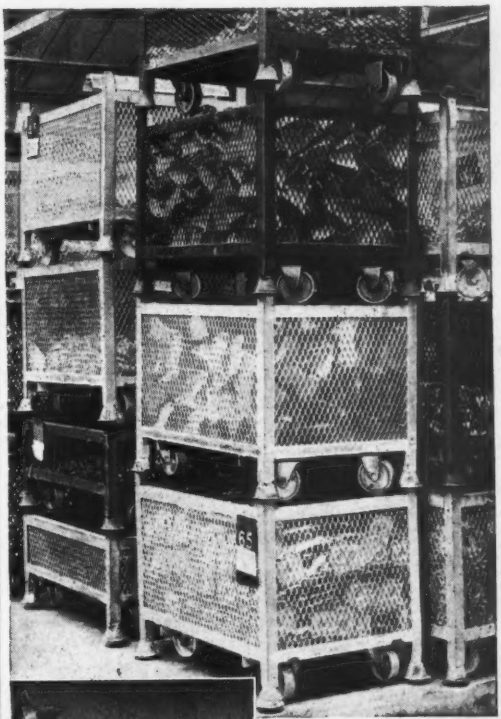

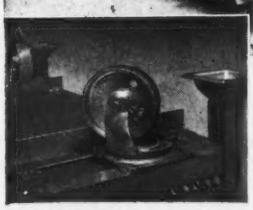

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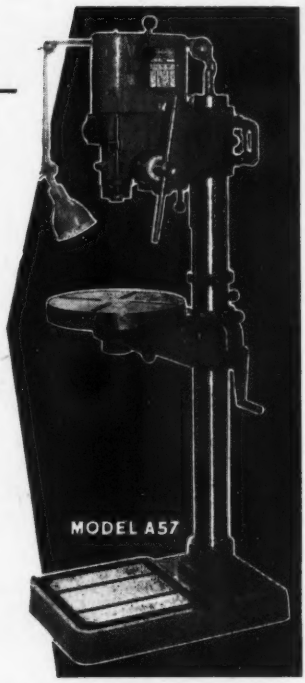

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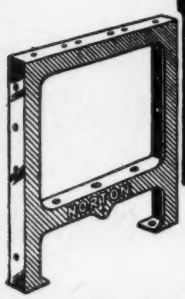

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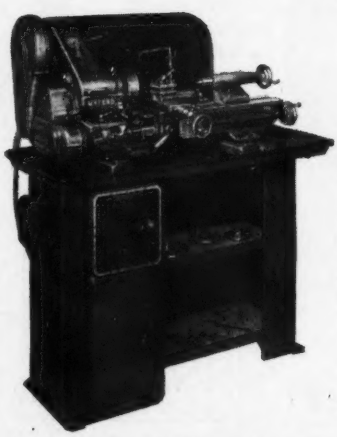

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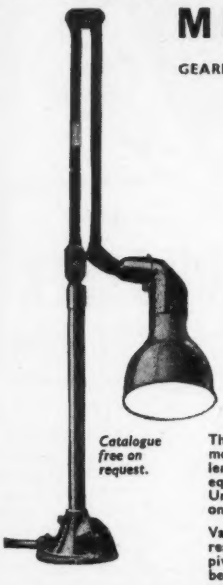

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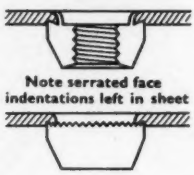

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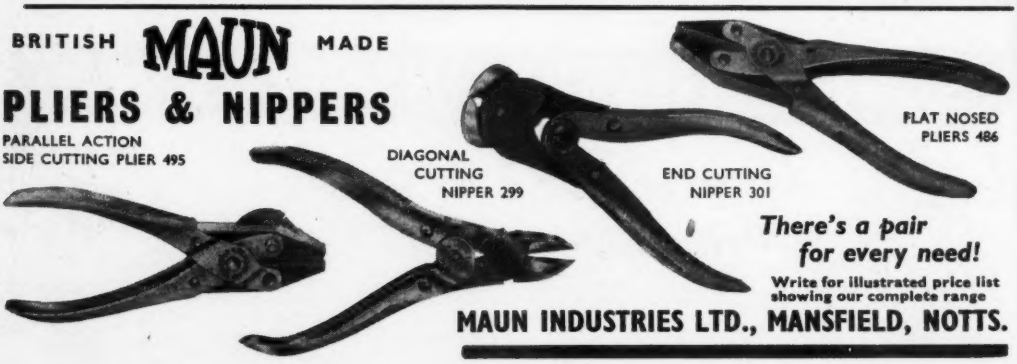

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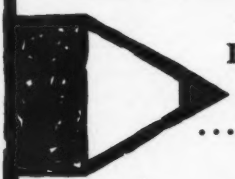

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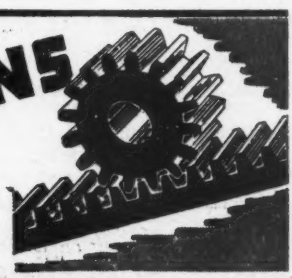

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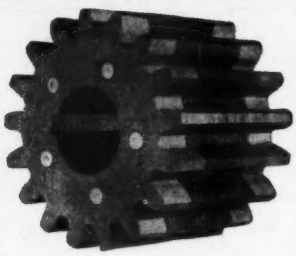

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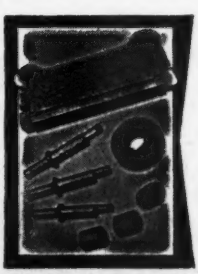

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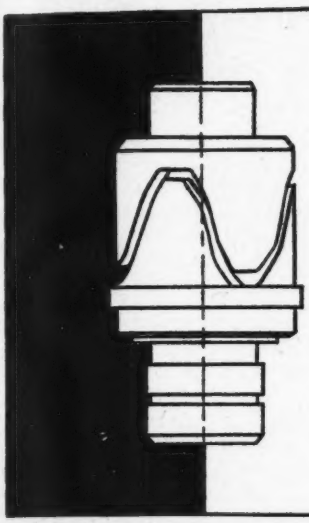

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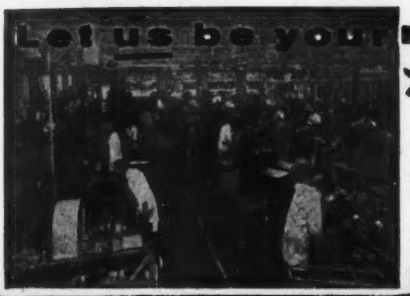

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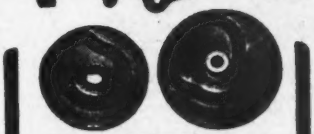

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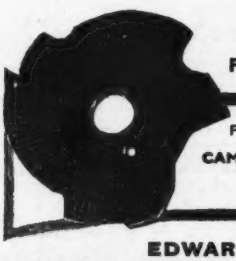

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LITTLEJOHN 5in. S.S. & S.C. Lathe on Cabinet Stand, 5in. 3-Jaw Chuck, 9 Collets and Collet Draw Bar, 400/3/50. £145.
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CARDIFF 8½in. S.S. & S.C. Gap Bed Lathe to admit 80in. between centres, approx. 2 years old (2 machines available).
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New **PROGRESS** 4E and 5E Pillar Drilling Machines.
ARCHDALE 5ft. Elevating Arm Radial Drilling Machine, No. 5 M.T. spindle.
New **RICHMOND** Model 8R.2 3ft. 0in. Radial Drilling Machine. Fixed arm No. 3 M.T. spindle.
SWIFT 4ft. 6in. Model A1 Elevating Arm Radial Drilling Machine, No. 4 M.T. spindle, motorised 400-440/3/50 cycles.

GRINDING MACHINES

BROWN & SHARPE No. 5 Horizontal Spindle Surface Grinding Machine, 24in. × 8in. capacity, hydraulic feed to table.
JONES & SHIPMAN Vertical Spindle Surface Grinding Machine, 18in. × 6in., hydraulic feed to table.
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MIDGLEY & SUTCLIFFE Hand Lever Feed Milling Machine, 16in. × 5in. table.
EDGWICK No. 2 Dial Type Plain Horizontal Milling Machine, 46in. × 11in. table.
ARCHDALE 20in. Dial Type Horizontal Milling Machine, 40in. × 12in. table.
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EDGWICK 18in. Horizontal Plain Production Milling Machine, with 40in. × 12in. table.

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ALLDAYS & ONIONS 2 cwt. Clear Space Type Pneumatic Power Hammer.
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SAWING MACHINES

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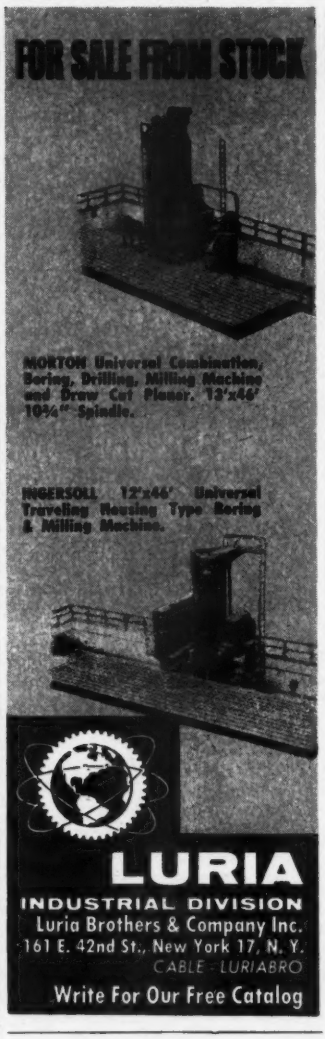
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LE BLOND 15 RP S. & S., 15in. × 24in.
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RYDERMATIC No. 12 Multi-Tool.
D.S.G. 13Z Minor, S.S. & S.C.
WILLSON 6½in. × 36in. Gap Bed S.S. & S.C

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ACME 5W Capstan, chuck machine.
HERBERT 2S, Flamard Bed.
WARD No. 7 Capstan, chucker.
HERBERT 4B D/L chuck and bar feed.
TAYLOR No. 1263 Capstan, ½in. cap.
BROWN & SHARPE No. 2WF 1in.
MURAD 3Q.

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HERBERT "V," "V" Junior and "C" Pillar.
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CORONA 3M Pillar, 1¼in. cap.

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MILFORD 6in. D/E Carbide Tool.
CHURCHILL BY, 10in. × 20in. "live" and "dead" workhead.
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BROWN & SHARPE No. 5 Surface.
BROWN & SHARPE No. 23 Plain, cap. 10in. × 48in.
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C.V.A. 79 swivel head.
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KENDALL & GENT Duplex Profile, table 15in. × 15in.

MILLERS—Horizontal

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CINCINNATI No. 2MH Plain High Speed.
CINCINNATI Mod. O8 Plain Automatic.
RICHMOND 2H8 Plain, table 35in. × 9in.
ARCHDALE 20in., table 40in. × 10in.
CINCINNATI Mod. O.K. Prod., table 34in. × 12in.
ARCHDALE 14in. Plain, table 27in. × 8in

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SHAPERS

ALBA 4S.
AMMCO 6in., cabinet model.
TOWN 14in.

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MAXICUT Gear Shaper, Model No. 2.

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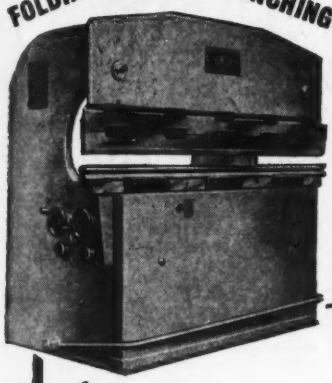

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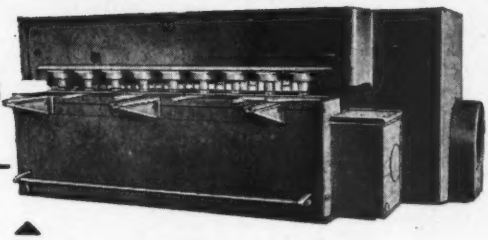

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Hydraulic Plain Horizontal Production Milling Machine, table 103in. by 26in., spindle speeds 24 to 179 r.p.m. Completely re-built.

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HERBERT No. 5 Auto Chucking Lathe, swing 18¼in. over bed. 3¾in. hollow spindle.

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KENDALL & GENT Screwing Machine, 3in. bolts, 6in. tubes. Tangential diehead with leadscrew.
MAIDEN 6in. Screwing Machine.
OSTER 6in. capacity Screwing Machine with cutting-off attachment for pipes; fully equipped.
KENDALL & GENT 3-2 Screwing Machine, capacity 3in. pipes, 2in. bolts, tangential diehead, leadscrew control.
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LANDIS 1¼in. Tangential Diehead Screwing Machine.

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ARCHDALE and **POLLARD** No. 3, 4 and 5 Morse Taper Production Drilling Machines.
New Heavy Duty Production Drilling Machines, No. 5 Morse Taper; hydraulic feed to spindle and table.
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A.C.E. 7¼in centres S.S. & S.C., 36in. between.
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Archdale 20in. Horizontal
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Archdale 18in. Vertical.
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Brown & Sharpe No. 2 Surface.
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Jones & Shipman 2-spindle, No. 3 M.T.
Pollard 5-spindle.
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Brown & Sharpe OG.

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CVA British Broaching Machine 6 ton, 36in. stroke.

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Secondhand **INGERSOL RAND.**
MIDLAND SAN.

DRILLS

HERBERT J TYPE. Single Column and two column machines.
ARCHDALE Snout Type Electrically Controlled Vertical Borer, 50 Int. Taper.
LELAND GIFFORD 2 Spindle No. 2 Morse Taper.
ASQUITH Horizontal Duplex M/c. No. 5 Morse, 5ft. dia. Rotary table.
ARCHDALE 2 spindle, mounted on a bridge with swivelling and centre distance adjustment. Power traverse to quills. No. 4 Morse. Table 92in. by 13in. working surface.
ARCHDALE UGD Power Feed, No. 4 Morse Taper.

RADIAL DRILLS

TOWN 5ft. Radial.
ASQUITH 6ft. D.C. Drive. £400.
ASQUITH OD2. 8ft.

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MIKRON type 79.
CLEVELAND 130D.
BARBER COLMAN No. 3 (2 machines).
GLEASON 3in. Bevel Gear Generator and equipment. Setting Gauges.
LORENZE SOO High Speed Gear Shaper, Rebuilt.

GRINDERS—CYLINDRICAL

PRECIMAX SP 1½, 7in. by 12in. Recond.
PRECIMAX MPL., 6in. by 24in. Plunge.
NORTON 6in. by 24in.
CHURCHILL 6 by 18 Hydraulic feed, hydrauto bearings.

GRINDERS—SURFACE

DOALL 20in. by 6in. Hydraulic Feed.
JONES & SHIPMAN Fig. 540. 6in. by 18in. Coolant Tank, Pump & Dust Extractor.
BLANCHARD 10C. 6in. Magnetic Rotary Table.
SNOW VB18, 84in. traverse by 15in.

GRINDERS—UNIVERSAL

JONES & SHIPMAN 10in. by 27in.
HENRI KAESER Model L. 10 by 20.
BROWN & SHARPE No. 13.

LAPPING MACHINES

HAHN & KOLB 26in. dia. with Coolant Filter Plant. Reconditioned.
PETER WOLTERS Hydraulic. Two Spindle Vertical Honing Machine.
NEWALL Hydro Lapper 24in. dia. of table, approx. 8 years old.

LATHES

SMART & BROWN Model A 4½in. by 24in.
WARD HAGGAS & SMITH faceplate Lathe, 57in. swing, 64in. in gap. Short bed with adjustable gap.
LE BLOND Production Lathe, 7in. centres by 36in. between.
TRIDENT Gap Bed 6½in. by 60in.
SPRINGFIELD 24in. by 12in. centres by 60in. between, speeds 9 to 280 r.p.m.
13Z DEAN, SMITH & GRACE 6½in. by 30in. between, SS & SC. Well equipped.
HOLBROOK Model 16H A.G.H., 1,000 r.p.m. SS & SC, 8in. by 36in.

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ACCURATOOL Capstan. Capacity ⅝in.
HERBERT No. 4, Senior Eloptive.
HERBERT No. 0
GISHOLT No. 3 Simplified Capstan.
ATLAS 1B 1in. capacity.
MODERN No. 1.
WARD No. 7 Capstan Lathe, covered bed, air chucking. Equipment fitted.
WARD 3A Capstans.
WARD 2A Capstans.
WARD 7 Capstan Lathe.

MILLING MACHINES

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CINCINNATI 08 Vertical.
THIEL Model 58 Tool Room Mill.
WADKIN High Speed Vertical Table 35in. by 13in.

Milling Machines—contd.

CINCINNATI No. 3 Vertical Sliding head (overhauled).
ALEXANDER No. 2, 3 Dimensional Pantograph Machine.
HERBERT No. 1 Hand Mill.
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HANSON WITNEY 9in. by 4in.
WICKMAN Moulton.
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WANDERER. 3in. capacity.

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85-ton **RHODES** Upright Geared.
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25-ton **RHODES** Inclinable.
35-ton **RHODES** Inclinable.
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FLY PRESSES No. 3.
HENRY & WRIGHT No. 6, Dieing Press, 25 tons.
H.M.E. 12 ton variable stroke ⅛in.—2⅜in., table 16in. by 20in. with 6in. hole, throat 7in., motorised 400/3/50, Udal guard fitted, excellent condition.

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WICKMAN 2¼in. 5-spindle Auto. 1941. machine.

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ARCHDALE 28in. Heavy Duty Pillar Drill.
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MAS Model V.R.4 4ft. 6in. Elevating Arm Radial Drill.

LATHES

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WARD 10 Combination Turret Lathe.
WARD 7 Combination Turret Lathe.
LANG 10¼in. Gap Bed. 5ft. between.

MILLING

28in. **ARCHDALE.** Rapid all ways.
18in. **EDGWICK** Production Mill.
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KENDALL & GENT Model C.V.M.25.
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8ft. **STIRK,** 2 tool heads on cross rail, table speeds 0.5-26.44 r.p.m.; table diameter 7ft. 3in.
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Vertical Boring and Turning Mill

1953 MACHINE
FIRST CLASS CONDITION

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Taper Turning. 50 h.p.

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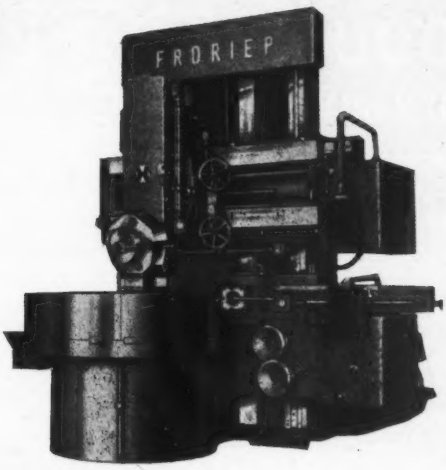

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WOLF 6in. Double-Ended Bench Grinder.

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CINCINNATI No. 3 Sliding Head Vert. Dial Selection. Table size 63in. × 15in.
CINCINNATI No. 3 Sliding Head Vert. Table size 55in. × 13½in.
VICTORIA V.2 Swivel Head Vert. Table size 45in. × 11in.
ADCOCK & SHIPLEY No. 1 Horizontal Milling Machine, table size 24in. × 7in.
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Selection of Nos. 1, 2, 3 and 5 Fly Presses.
SWEENEY & BLOCKSIDGE 50 ton Cap. Power Press, adjustable stroke.
JONES & SHIPMAN Double Column Bench Arbor Press.
JONES & SHIPMAN Straightening Press. Model Fig. 85.

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MELBO 6in. Cap. Hacksaw.

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INVICTA 1M 10in. Stroke Shaper.
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SWEENEY & BLOCKSIDGE No. 14A Open Fronted Inclinable Power Press. Motorised for 400-440/3/50 supply. Capacity 70 tons. Stroke 2in. Bed 36in. × 20in. Hole in bed 14in. diameter. With detachable tie bars. Weight approx. 90 cwt.

BERTRAM Double Geared Open Fronted Power Press. Motorised for 400/3/50 supply. Punching pressure approx. 180 tons. Stroke 4½in. Between side frames 75in. Bed 74in. × 17½in. Hole in bed 72in. × 2½in. With removeable tie bars. Weight approx. 10 tons.

TWO NEW **LEN. 40/250** Open Fronted Inclinable Power Presses. With adjustable stroke. Motorised for 400-440/3/50 supply. Pressure exerted 40 tons. Depth of throat 9½in. Adjustment of stroke ⅛in. to 3⅛in. Table 18½in. × 25⅛in. Hole in table 8½in. diameter. Weight approx. 58 cwt.

BLISS No. 85 Double Geared Double Sided Reducing Press with straight sides. Pressure about 50 tons. Stroke 14½in. Between uprights 22in. Bed 21in. × 21in. Hole in bed 9½in. diameter. Spare crankshaft with 5in. stroke. Friction clutch. Arranged motor drive 400/3/50.

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Newman

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CONOMATIC 3½in., 4-spindle Bar Auto.
BULLARD Multi-Au-Matic 7in. 8 spindle.
BULLARD Multi-Au-Matic 12in. 6 spindle

BORING MACHINES

WETZEL Horizontal traversing column Floor Boring and Facing Machine, 7in. diameter travelling spindle, 45in. diameter facing head. (Two available.)
KEARNS Model OC Horizontal Boring Machine, 3in. dia. travelling spindle.
WEBSTER & BENNETT Vertical Boring Machine, table 50in. diameter.
RICHARDS Type PRT Horizontal Floor Boring Machine, 3½in. travelling spindle, 28in. diameter facing head.

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CHURCHILL-REDMAN Model 13NM Heavy Duty S.S. & S.C. Gap Bed Centre Lathe, 13in. centre height × 72in. between centres. Swing in gap 50in.
OLDFIELD & SCHOFIELD Surfacing and Boring Lathe, 10½in. centre height.
WARD 7B Combination Turret Lathe.
NILES Heavy Duty Centre Lathe, S.S. & S.C. 17in. centre height × 28ft. between centres.

DRILLING MACHINES

ASQUITH Model OD.1 5ft. Elevating Arm Radial Drilling Machine.
HETTNER Radial Drilling Machine, 10ft. elevating arm.

GEAR MACHINES

ORCUTT Model HM24 Hydraulic Internal Gear Grinder.
GLEASON 3in. Straight Bevel Gear Generator.

GRINDING MACHINES

NEWALL Type LA Plain Hydraulic Cylindrical Grinding Machine, 10in. × 36in. (Two available.)
CHURCHILL Model HBY Internal Grinding Machine.
CHURCHILL Plain Cylindrical Grinding Machine, 26in. swing × 84in. between centres (1951).
LANDIS Type C Plain Hydraulic Cylindrical Grinding Machine, 6in. swing × 18in. between centres.
ORCUTT Model HM24 Internal Spur Gear Grinding Machines.
CHURCHILL Plain Hydraulic Cylindrical Grinding Machine, 20in. swing × 54in. between centres.
BROWN & SHARPE Plain Cylindrical Grinding Machine, 10in. swing × 36in. between centres

MILLING MACHINES

CINCINNATI Model 5/72 Plain Hydromatic Milling Machine, table 91in. × 22in. (1952).
CINCINNATI No. 2L Plain Horizontal Milling Machine, table 52in. × 10in.
PRATT & WHITNEY Model BL3620 3-spindle "Keller" Die Sinking Machine.
CENTEC Model 3R Automatic Production Milling Machine, table 25in. × 16in.

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CAPSTAN LATHES

WARD No. 7 capstan lathe, covered bed, 2in. bar capacity, with collet and bar feed, surfacing, sliding and screwcutting, maximum swing 16½ in. spindle speeds 37–750 R.P.M. (2 machines available.) **Price £1,250 each.**

DRUMMOND K. capstan lathe, chucking machine, spindle bored 2 7/16in., power feeds to cross slide, saddle and turret, maximum swing 17in., maximum distance spindle to turret 30in., spindle speeds 60–1,000 R.P.M. **Price £375.**

WARNER & SWASEY No. 5 capstan lathe, chucking machine, spindle bored 2½in., power feeds to cross slide, saddle and turret, maximum swing 19½in., spindle speeds 26–658 R.P.M. **Price £650.**

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WARD No. 16 turret lathe, covered bed, 32in. chuck, spindle bored 8½in., screwcutting, power and rapid feeds to cross slide, saddle and turret, power rotating turret, spindle speeds 7–225 R.P.M., maximum distance spindle to turret, 99in. **Price £3,500.**

WARD No. 10 turret lathe, covered bed, chucking machine, spindle bored 4½in., screwcutting power feeds to cross slide, saddle and turret, rapid feed to turret, power rotating turret, maximum swing 23in., spindle speeds 19–580 R.P.M. **Price £975.**

HERBERT 7A Preoptive turret lathe, as above, but fitted with taper turning attachment and collet head. **Price £990.**

CENTRE LATHES

HOLBROOK 6½in. centre lathe, straight vee bed, 30in. between centres, surfacing, sliding and screwcutting, spindle speeds 15–400 R.P.M. quick change gear box, taper turning attachment. **Price £325.**

DEAN, SMITH & GRACE 4BR 10in. centre lathe, straight bed, 42in. between centres, surfacing, sliding and screwcutting, spindle speeds 27–602 R.P.M., patent feed box, taper turning attachment. **Price £700.**

GRINDING MACHINES

BROWN & SHARPE No. 2 surface grinder, mechanical feed, 18in. × 6in. capacity. **Price £180.**

WICKMAN 14C double sided tool grinding and lapping machine, 14in. × 2in. × 1½in. double faced grinding wheels, 31in. × 19½in. recessed canting tables, coolant pump. **Price £250.**

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Table size 67in. x 14½in.
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Rapids in all directions.
Complete with all standard equipment.
Ex. Cond. 9 h.p. 440/3/50.

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BARBER COLMAN 6/10.
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CHURCHILL HBY.
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LUMSDEN Vert. 210 XXM.
ABRASIVE No. 34 Vertical Spindle.

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NEWALL 6 × 18. Model XL.
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VICTORIA U2 type fully Universal with Div. Head, Vert. Head, Rotatable Table.
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2A MINGANTI Capstan Lathe.
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54in. × 15in. **CRAVEN** Universal Milling Machine.
HERBERT S.E. Capstan Lathe.
CRAVEN Worm Milling Machines.
No. 48 **B.S.A.** Single Spindle Automatic, ¾in. capacity.
2A WARD Bar Feed Capstan, complete with equipment.

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WARD, HAGGAS & SMITH 16in. All Geared Head S.S. & S.C. Gap Bed *CENTRE LATHE.* Admits 11ft. 6in. between centres. Hollow spindle bored 3½in. dia. Swing in gap 49in. 18 spindle speeds 2 to 62 r.p.m. Motor drive 400/3/50. Price: £925

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DEMOOR Model 821 8½in. All Geared Head S.S. & S.C. Straight Bed *CENTRE LATHE.* Admits 6ft. 7in. between centres. Hollow spindle bored 2in. dia. 18 speeds 25 to 1,250 r.p.m. Motor drive 400/3/50. Price: £900

CHURCHILL Open Side Horizontal Spindle *SURFACE GRINDING MACHINE.* Table size 36in. × 8in. Variable hydraulic traverse. Hand-operated rise and fall wheelhead. Complete with electric magnetic chuck and coolant equipment. Motor drive 400/3/50. Price: £750

ABWOOD Model TH2 Vertical Spindle Tool and Die *SURFACE GRINDING MACHINE.* Table size 21½in. × 9½in. Fitted with 5in. dia. cup type grinding wheel. Hand feed to table. Hand and auto. feed to knee. Complete with magnetic chuck, tool and cutter grinding equipment and motor driven suds equipment. Motor drive 400/3/50. Price: £325

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Classified Advertisements (*PLANT FOR SALE, contd.*)

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DRILLING MACHINES

PROGRESS No. 3 Pillar Drill.
ASQUITH O.D.1 3ft. 6in. Radial. 5 Morse Taper. D.C. Elecs.
PROGRESS 4E Pillar Drill.

GRINDING MACHINES

New **N.1.** 10in., 12in., 14in. 16in. and 20in' D/E. Tool Grinders.
RUSSELL 40in. Saw Blade Sharpener.
PRECIMAX M.P.H. 10in. × 24in. Hyd. Plain Cyl. Grinder, plunge feed.
CHURCHILL 10in. × 24in. Hyd. Plain Cyl. Grinder.

GUILLOTINE

PRATT 3ft. 6in. × 16 Gauge U/Crank Power Guillotine.

LATHES

COLCHESTER 8½in. × 4ft. 6in. Gap Bed Lathe.
HERBERT No. 4 Capstan Lathe, 2¼in. H/Spindle. Spds.—511.
HERBERT 7 Junior Comb. Turret, 2in. H/Spindle. Spds.—767 r.p.m.
HERBERT 9 Comb. Turret. H/Sp. Spds.—400 r.p.m.
HERBERT Carbicut Lathe. Spds.—3,025 r.p.m.

MILLING MACHINES

MILWAUKEE 3.H Horizontal Milier. Spds.—1,000. Table 63in. × 13½in.

NIBBLER

W.F. 14 Gauge Nibbler. 59in. throat.

POLISHING SPINDLES

CANNING 5 h.p. Double Ended Polishing Spindles.

PRESSES

BRADLEY & TURTON No. 3 Flypress.
NORTON No. 4 Flypress.
TAYLOR & CHALLEN "1274" Notching Press.
TAYLOR & CHALLEN "370" 20 ton O/F. Power Press.
SWEENEY & BLOCKSIDGE 20 ton O/F. Power Press.
EDWARDS No. 21 40 ton O/F. Power Press.

SAWING MACHINES

RAPIDOR 6in. Power Hacksaw.
NEW **RAPIDOR** 6in. Power Hacksaw.
SPEEDAX 9in. Power Hacksaw.
BARSON No. 1 High Spd. Circular Saw. Cap. 1¾in. rounds. 2in. tubes, 1¾in. × ¾in. flats, 1¾in. × ¾in. angles.

SHAPING MACHINE

CHURCHILL REDMAN 18in. Shaper. Univ. Table. 400/3/50 electrics.

WELDING EQUIPMENT

PRESCOTT 15 K.V.A. Spot Welder.

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WANDERER Type OFE. Horizontal Milling Machine. Working surface of table 39½in. × 9½in. 9 spindle speeds 67 to 1,050 r.p.m. Power feed all ways. 400/3/50.
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TAYLOR & CHALLEN B3 Geared, Open Front, Power Press. 40 tons pressure. 4in. Stroke. Bed area 30in. × 22in. Throat 11½in. Latest type. 400/3/50. Fully guarded.
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No. 4 Kearns Patent Horiz. Boring and Facing Machine, with 4in. dia trav. spindle. Automatic facing, 54in. dia Main table 66in. × 42in. Top table 48in. × 48in. Balanced head.—LEE & HUNT, LTD., Crocus Street, Nottingham. 'Phone 84246.

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KITCHEN & WADE Vertical Fine Boring Machine, 14in. stroke. Compound table.

DRILLING MACHINE

ARCHDALE 8-Spindle Hydraulic Vertical Drilling Machine.

GRINDING MACHINES

BROWN & SHARPE No. 5 Surface Grinder, 10in. throat.
BROWN & SHARPE No. 2 Surface Grinder, 18in. × 6in. table.
HEALD No. 172 Gap Bed Internal Grinding Machine, maximum diameter of component 36in.

LATHES

N.D. 8in. × 6ft. S.S. & S.C. Lathe, 30in. between centres.
NOBLE & LUND Heavy Duty Centre Lathe, 22in. centre height × 29ft. between centres. Max. swing over saddle 33in. dia.
HARVEY Heavy Duty Centre Lathe, 42½in. centre height × 52ft. between centres. Max. swing over saddle 5in. dia.

MILLING MACHINES

EDGWICK No. 2 Universal Milling Machine. Working surface of table 38in. × 7½in.
BROWN & SHARPE No. 3A Universal Milling Machine with Vertical Head Attachment. Spindle speeds 30/1,200. Power feed all movements.
COLLET & ENGLEHARDT Keller Type Die Sinking Machine. Model FKf80 capacity 60in. × 30in.

PLANING MACHINES

CLEVELAND Openside Planing Machine, capacity 10ft. × 2ft. 6in.
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SUNDSTRAND No. 0 Rigidmil. Capacity: 18in. feed.

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ARCHDALE 18in. Production Mill.

ARCHDALE 24in. Production Mill.

MILWAUKEE No. 1224 Duplex. Capacity: 24in. feed.

CINCINNATI No. 3/24 Plain Hydromatic. Capacity: 24in. feed.

ARCHDALE 36in. Unit Construction Automatic Mill.

CINCINNATI No. 3/36 Plain Hydromatic. Capacity: 36in. feed.

CINCINNATI No. 4/36 Plain Hydromatic. Capacity: 36in. feed.

All with electric drive suitable for 400 volt, 3 phase, 50 cycle A.C., and in good operating condition.

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ASQUITH Type EGC. 6ft. Girder Type Radial Drilling Machine. Spindle bored No. 5 M.T. 6 spindle speeds 220 to 905 r.p.m. Travel of quill 12in. Auto feeds 4 to 0.0083 to 0.027in. per rev. 400/3/50.
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NORTON 12 × 36 Universal Grinding Machine.
CHURCHILL Model HBB Internal Grinder.
BOURDON Model PM2 Vertical Spindle Surface Grinder.
LANG 18in. swing Surfacing and Boring Lathe.
PALLAS Model H.O. Miller. Table 30in. × 8in.
CINCINNATI No. 2 Centreless Grinder.
HERBERT No. 1 Hand Milling Machine.
ARCHDALE 18in. Plain Horiz. Miller.
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All machines motorised 400/3/50.

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Height of centres	17¾in.
Swing-over bed	36in.
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Distance between centres ...	30ft.
Number of spindle speeds ...	24
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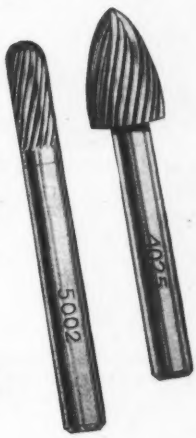

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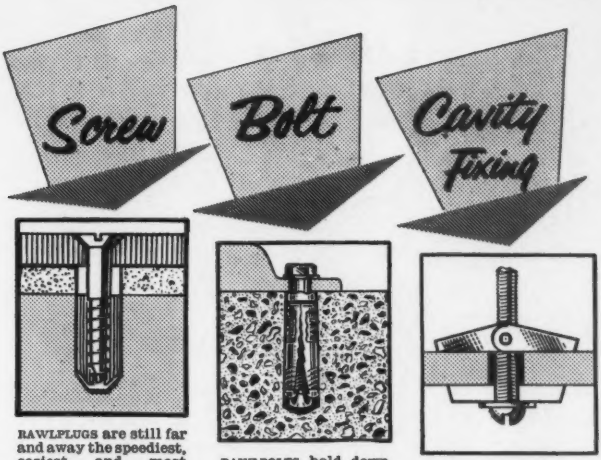

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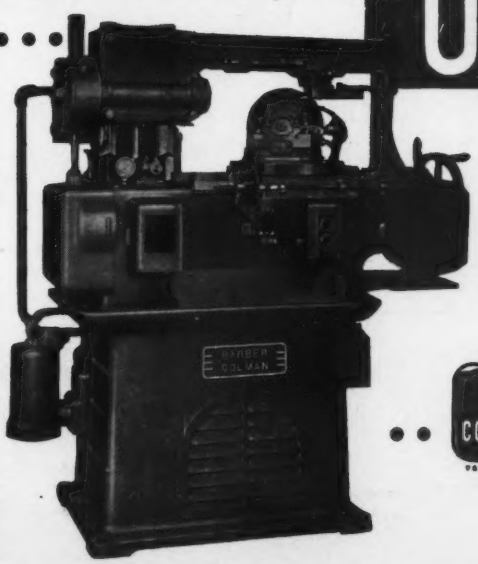

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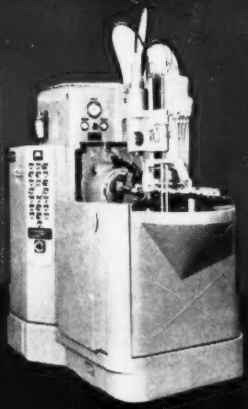

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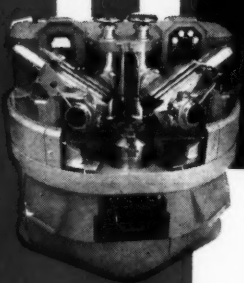

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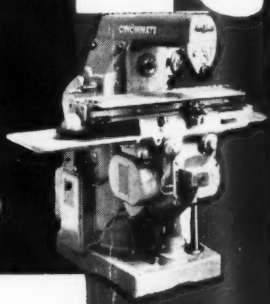

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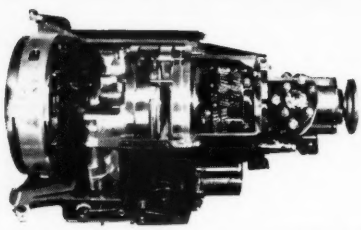

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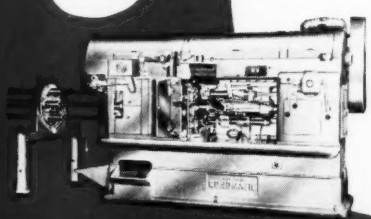

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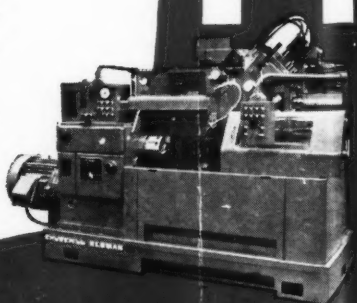

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MACHINE TOOL TRADES ASSOCIATION ANNUAL DINNER

Supplement to **MACHINERY,** *November 22, 1961*

The Machine Tool Trades Association Annual Dinner

At The Annual Dinner of the Machine Tool Trades Association, which was held at Grosvenor House, London, on November 16th, the President, Mr. J. C. Snow, who was in the Chair, introduced The Rt. Hon. Harold Watkinson, M.P., Minister of Defence, who proposed the toast of "The Association." Mr. Watkinson first spoke about the larger issues which lay behind the problems of the Common Market, and the need for greater unity among the industrial nations of the West. The Communist world, he pointed out, commanded a market of 950 million people, and although the population of this country and the remainder of the developing and emerging Commonwealth collectively numbered 650 million, this population was widely spread over the world.

Near at hand, however, there was another community of 170 million people who together imported large quantities of high quality manufactured goods. It obviously made sense, therefore, to seek a means of linking the Commonwealth and Europe in a great trading community. In the long term, moreover, it was difficult to see how the United States would be able to avoid being more closely associated with this kind of trading community.

(left to right) **Mr. E. W. Feild, O.B.E., a Past President, Mr. R. D. G. Ryder, a Past President, and Mr. J. C. Snow, President of the M.T.T.A.**

In the N.A.T.O. alliance we had all signed away a large proportion of soverignty for the necessary military purpose of being strong and united. Whatever view one held of the difficulties and problems, therefore, if we were to live among, and trade and compete with other big power groupings in the world, it was surely desirable that we ourselves should belong to the biggest "club" we could achieve.

The Common Market, however, was not something that would put all our problems right. One heard people say of some restrictive practice: "That will not last long if we go into the Common Market." Surely, however, it would be better to put such failings right before joining and not after. If there was a large-scale strike in Britain there was only one winner—the foreign competitor. Often, where there were restrictive practices, slackness, and generally indifferent relations in industry, it was not the fault of the trade unions but of management, and that situation must be put right. In that company, said Mr. Watkinson, he was speaking to the converted, because in the small, personally-managed machine tool industry there were good labour relations.

If the plan for joining Europe and the Commonwealth was to be made to work, we should have to try very hard when we got to the actual details, in just the same way that governments tried—and must try even harder—to solve the problems involved in military interdependence. We were a small island with big responsibilities, and if we could not knit a large portion of the world together, he did not believe that anyone else would be able to do so. The matter was in the hands of us all and in the hands of the government, and we had to try to find a successful solution in order to live in a peaceful, prosperous world.

(*left to right*) Mr. A. Graham Dowding, Hon. Treasurer, Mr. T. N. Woof, M.C., Chairman, Machine Tool and Small Tool Importers' Section Committee, and Mr. J. G. Petter, the new Vice-President of the M.T.T.A.

In thanking Mr. Watkinson for his "most interesting, excellent, and authoritative speech," the Chairman recalled that he had at one time been interested in the making of grinding wheels, and went on to suggest that his rapid elevation to ministerial rank might owe something to the experience which he had gained in the early days of the Association's Production Efficiency Panels.

The machine tool industry, said Mr. Snow, had been criticized for lagging in research and development, for inability to supply United Kingdom industry with certain types of machine tools when they were needed, and in some instances for breaking delivery promises. In this connection he was reminded of the story of the customer who, having waited for a considerable time, sent a telegram saying: "Cancel order immediately." Back came the reply: "Regret cannot accept immediate cancellation. You must wait your turn."

There was, however, another side of the picture, and the industry was in fact doing a "magnificent job of work" both at home and abroad. Since the war they had been relied upon to supply—and had supplied—80 per cent of the United Kingdom's demand for machine tools—a record as good as that of any other machine tool manufacturing country in Europe.

Under the Treaty of Rome there had been a marked expansion in machine tool consumption in the Common Market area in a very short period of time. Despite the less favourable tariff conditions which this country had had to face, moreover, our machine tool exports to the "Six," according to the latest available figures, had expanded by almost 100 per cent since 1960.

He was certain, however, that too large a proportion of the impressive export figures, which were now running at about 28 per cent of output, was being provided by far too few of their members. Most of them knew the importance of exports to-day, and he would urge members who had not yet found the means, or the interest, to add their weight to the export effort, to think very deeply about the matter. Surely by now they must all realize that the economic stability of this country, and even the standard of living we enjoyed, depended on the volume of exports. If exports failed, the country would fail, whether or not we joined the Common Market, and he could not stress too strongly, therefore, the importance of this aspect of their business.

It was easy to say: "I have got twelve months' work in hand, it is easy to sell my machines to my regular customers so why should I trouble about finding credit and arranging for exports of my goods all over the world?" If all our exporting industries thought in that way, however, where should we be?

They had to thank the men on the Export Committee of the M.T.T.A., which comprised a dozen or so lively people of export director or export manager calibre, who were arranging

Sir Steuart Mitchell, K.B.E., C.B. (*left*), Controller of Guided Weapons, Electronic and Atomic Warheads, Ministry of Aviation, and Mr. J. C. Snow

Mr. J. C. Robinson (*left*), a Past President, and Mr. C. H. Morris, Chairman, Woodworking Machinery Manufacturers' Section Committee, M.T.T.A.

a series of regional meetings, the first of which was to be held next month in Leicester, to enable members to get together and help each other in this important project. He would ask whoever might be interested to send representatives of the highest calibre to the meetings in their particular areas.

During the past year or so, he had noticed a new keenness and awareness amongst members of the committees and the Council of the problems which the industry had to face, and he had been most impressed by the way in which those problems were being tackled. It was not long ago that they had realized the necessity for providing advanced educational facilities for machine tool designers. As a result of this idea an arrangement had been made with the Manchester College of Science and Technology for the further education of 10 scholars per year, by means of a two-year course in machine tool design and technology. They were now seeing the first fruits of that effort, in that within the last two or three months the first turnout of those scholars had been produced for the industry.

He knew from his own experience what a considerable sacrifice it was to have to release an up-and-coming young machine tool designer with the necessary qualifications, for two years, but experience had proved that it was well worth while. For a long time he had heard the industry complain of being desperately short of good machine tool designers. While the means of providing them were at present limited, with the support of the machine tool builders something much larger could be achieved which could provide the industry with the highly qualified designers it must have.

This year they had passed another milestone in that they had achieved the creation of the first Chair in machine tool technology at Manchester University, and it was with very great pleasure that he welcomed the presence of Prof. Koenigsberger—our first professor of machine tool technology.

The M.T.T.A. had first conceived the idea of forming a research association some two years ago, and a sub-committee of the Economic Policy Committee was entrusted with the task of establishing the M.T.I.R.A. That sub-committee had become the first Council, and high tribute should be paid to those who had done so much to create what was now an established, Government-supported, research association.

They had hoped to have with them Lord Halsbury, who some months ago had agreed to become their first President, but unfortunately he was indisposed. Under his sympathetic presidency, there was no danger of the Association becoming moribund or a "white elephant." With that organization now in being, and adequately and generously supported by the Government, they hoped to go ahead.

He was quite sure that if the Government would accept the wisdom of providing that machine tools, and other capital equipment, should be

Mr. A. W. Lee (*left*), a member of the Allied Trades' Section Committee of the M.T.T.A., and Mr. H. Burke, President, Institution of Production Engineers

written off in five years instead of ten, one of the major export problems would be solved. A machine tool which was ten years' old might be working very well, but bearing in mind the technical developments which had taken place over the last ten years, a machine of recent manufacture must surely offer great advantages in terms of production.

Speaking of the European Machine Tool Committee, with a membership of ten nations from among the "Six" and the "Seven," Mr. Snow referred to the fact that a few months ago they had elected their new President—Mr. Robert Asquith. It was indeed a great honour for him, and reflected honour on their Association and their industry.

Mr. Snow then proposed the toast of "The Guests," with which he coupled the name of Lord Knollys, Chairman of Vickers, Ltd.

In responding to the toast, The Rt. Hon. Lord Knollys, G.C.M.G., M.B.E., D.F.C., pointed out that the decision as to whether or not this country entered the Common Market was now in the hands of the Government who had certain safeguards to negotiate, particularly as regards the interests of the Commonwealth. British industry, however, could not wait for what might be a long-delayed decision before it got right down to ensuring that it was able to compete as it had never had to compete before.

As a country we were faced, first, with the new and intense competition in Europe, but he believed that it would not end there. The conception of Common Markets was spreading to other parts of the world. In the United States business men were beginning to realize the effects on their trading to Europe which our entry into the Common Market might have. Even members of the U.S. Government had stated that the European Common Market could be a threat to the trade of the United States, and that they must consider how they might eventually be associated with it.

The existence of this situation, surely, must be a further spur to us to prepare ourselves for the spread of competitive markets. It was necessary, of course, to continue modernizing and re-equipping more completely than had yet been done, in the search for greater efficiency and economy. For this reason, the ingenuity of the machine tool builder in developing new and more sophisticated machine tools was going to be tested as never before. It was even more important, however, than being competitive in methods and machines, that we should ensure that we were competitive in men and in ideas,

The Rt. Hon. Lord Knollys, G.C.M.G., M.B.E., D.F.C. (*left*), Chairman of Vickers, Ltd., and Mr. H. O. Barrett, General Manager and Secretary of the M.T.T.A.

and here we still had some way to go. To ensure that we had the men best able to stand up to the tremendous competitive battle which faced us, we had to educate and train them, and industry had to do its part in ensuring that the necessary technical educational facilities were provided, if more skilled minds were to be made available.

Lord Knollys then quoted from a speech made by Sir Winston Churchill last month on the occasion of the laying of the foundation stone of Churchill College, Cambridge, which has been founded for scientific and technical study.

> "Britain must not be left behind. It is inconceivable that our country, with its traditions of pioneering and discovery in every field, and its magnificent resources of men and intellectual power, should be constrained by our own inactivity to wait for other countries to impart to us the knowledge they have gained. Whether in the fields of pure research or applied technology, whether in the adventure into space or in the minute investigation of the substance of our globe, we must as always before be with the leaders."

They had also to ensure that the training plans in their own businesses were really effective and realistic, otherwise it would be impossible to attract and keep the best young men. The days of "just learning on the job" had gone. He had found in his own Group that it was not enough just to provide opportunities and courses of training for young men in all departments—

technical, sales, and managerial. One had to be sure that bright young men were able to feel that someone really interested was keeping an eye on their progress—someone to whom they could go and talk about their futures. He believed, too, that those conditions could best be brought about if heads of businesses themselves showed clearly their personal and direct interest in that all-important subject.

The constant and compelling need for new competitive ideas brought him to the subject of research—in its broadest aspects. Here he would like to congratulate the Association on the developing research activities, a matter of vital importance, as was evidently recognized. He was sure that all in industry would derive great benefit from what the machine tool builders were doing for themselves and indirectly for industry, in that field.

He did not think that research had enjoyed the status or the financial support in this country which it obviously still needed. Surely, however, to be really research-minded, people—and especially youth—needed a keen spirit of enquiry and an almost incurable anxiety to know and to ask "Why?" He was sure that those who attended the British Trade Fair in Moscow last June would have been struck by the continuous questioning of those who visited the stands as to: "How does it work?" and "What is it made of?"

He thought that we had lost something of that spirit of questioning, of wanting to know, of readiness to learn from others, which was such an essential element in producing new ideas, and in research.

There was, moreover, one last quality which, he suggested we had got to have if we were not to fail in the tough times which lay ahead. Above all, we had got to have a new approach to all the problems, and fresh, uninhibited, modernized thinking as to how to solve them. He did not believe that, as yet, we were all tuned-in to the wavelengths of the new economic world, and some of those wavelengths undoubtedly were coming from countries within the Common Market which seemed to have found new ways of solving old problems.

We were undoubtedly facing a revolution in world trade relationships, but if we could, by various means, equip ourselves to be as competitive as we must be, if we could abolish all out-of-date thinking, which, it appeared, still existed in some sections of industry to-day, then we could win through and show the world that the leaders of the Industrial Revolution a century ago could do it again. He was sure that his audience believed—as he did—that we could.

(*left to right*) **Mr. Phillip Neill, Chairman, Allied Trades' Section Committee, Mr. J. C. Snow, and Mr. J. P. Hunt, who has recently resigned from the Vice-Presidency of the M.T.T.A.**

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